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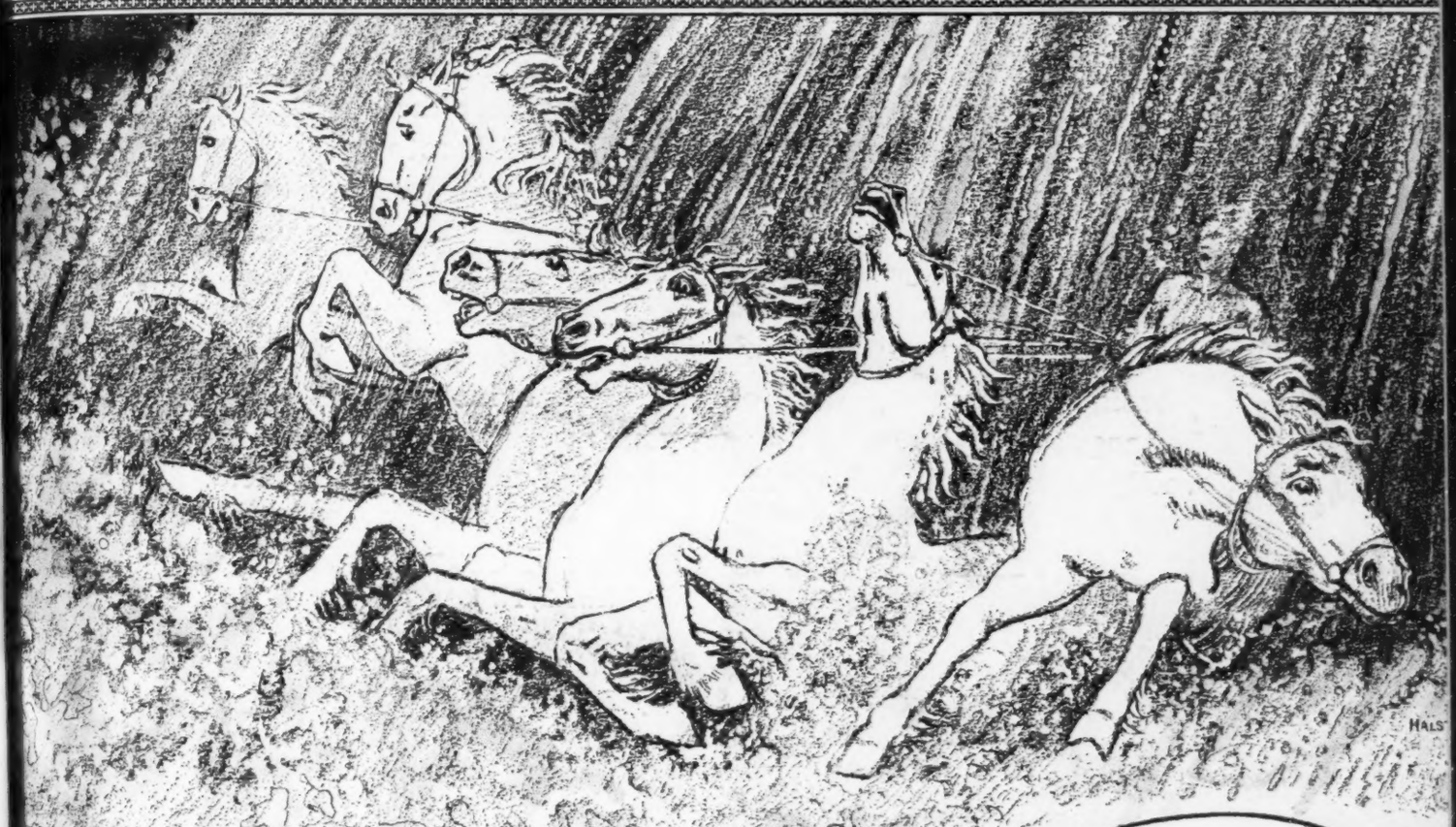

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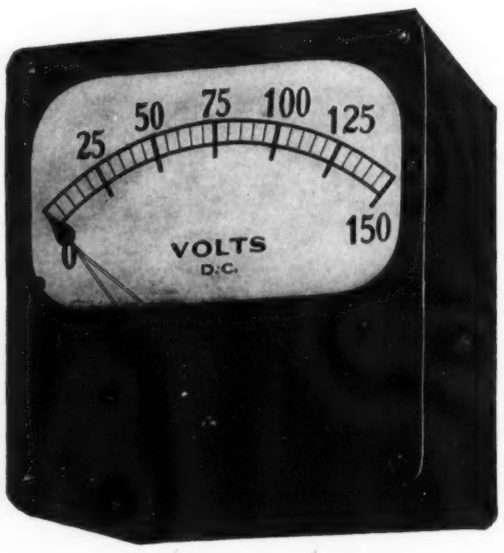

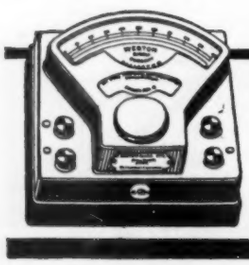

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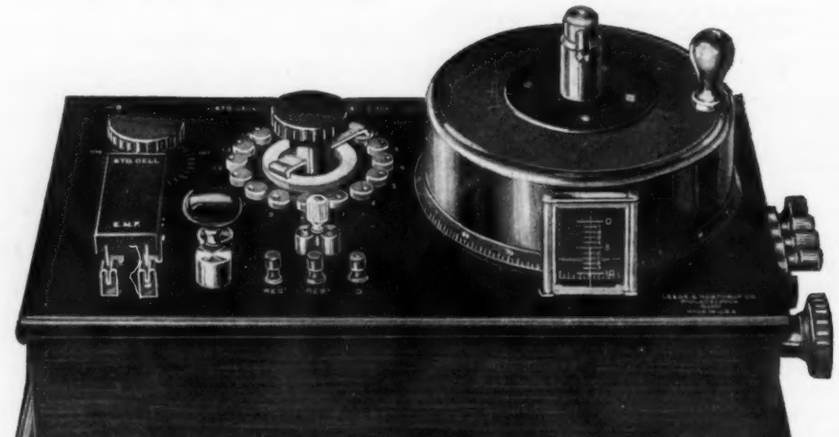

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, May 21, 1927* — NUMBER 21

The Coming N. E. L. A. Convention

THE great convention of the electrical industry—by many regarded as one of the greatest annual conventions held the country over—is drawing near. From the tentative program given out by the National Electric Light Association it appears that this year's meeting at Atlantic City will lack nothing of the high standards of previous conventions. To miss it therefore will be a loss, for although one may read all of importance that has taken place, the inspiration and enthusiasm which one gains from personal observation and contact, the indelible impression left on the mind by an assemblage of thousands of enterprising men engaged in the same business, cannot by any stretch of the imagination be imbibed from the printed record. Besides, the exhibition, if it comes up to that of last year—and it is said it will be better—will itself be worth crossing the country to see.

There are, of course, those who get more from these meetings than others, chiefly because they give more to them or because they come to learn. No one, however, can count the time lost, for impressions, even on a closed mind, cannot be easily obliterated; and if out of the mass of material presented just one idea is gleaned, the cost is cheap. In the electrical industry, as probably in none other, there is a permeating spirit of friendship and comradeship in evidence. That is why there is so much unity and enthusiasm in the business. The source of this spirit can be traced in large part to conventions like that scheduled for June 6 to 10. It explains why they are so well attended, so profitable and so worth while to the electric light and power industry.

Transmission Versus Local Generation

AS ELECTRICAL development rises to higher planes of economic importance reliability of service becomes paramount. The requirements of densely populated areas have now reached a point where continuous and high-grade service must be maintained about as steadily as with the water supply. Proximity to principal load centers, therefore, becomes a vital essential in generating-plant location. During the last few years noteworthy advances have been made in the prevention of interruptions and other troubles on transmission circuits, but the triumphs of interconnection have led many engineers to underestimate the importance of local generation. Some indeed have gone so far as to stigmatize as economic crimes the building of additional generating plants on city waterfronts within a hundred miles or so of good hydro-electric power sites.

It is no slur upon transmission engineering to point out that the standards of reliability demanded by modern important cities still tax the resources of the designer and of the operator very heavily indeed, and that complete metropolitan reliance upon transmission from distant points is not yet warranted by experience. The risks are too great for the best standards of service, although we may expect to see practically continuous improvement in service performance for many years, taking the industry as a whole. Interconnection is making fine records in relation to service continuity and operating economy all over the country, but the mistake must not be made of belittling the value of efficient large-scale local generation in important cities on tidewater, lakes or rivers where engineering investigation indicates the desirability of such practice from the standpoints of low-cost production and of maximum-quality service. Co-ordination rather than elimination should be the aim in dealing with situations of this sort.

Co-operative Method of Engineering Education

EDUCATION is not a matter of quantitative definition or of measurement in exact terms. It is too closely tied with human attributes and environments to suffer cataloging. But it is a fundamental aspect of life and intimately influences the development of civilization.

Engineering education has been investigated very thoroughly by the board of investigation and co-ordination of the Society for the Promotion of Engineering Education. Facts, opinions, statistics, trends and conclusions have been published and studied. One of the topics of interest deals with the co-operative method of engineering education. Time is supposed to tell, and twenty years have elapsed since the University of Cincinnati embarked upon the co-operative plan. Today sixteen institutions offer this type of course, and many students serve in industry and study in the classrooms in alternative periods during their college course.

The method works in practice, but no definite conclusions can be reached as to whether it is better or worse than the orthodox four-year course. In general, the financial gains, the acquisition of competency and the industrial demands for the students are the same for the two methods. On the average, however, the co-operative method prepares students for administrative and operating positions in industry and has elements which appeal to minds of a practical bent. It it less appealing to the philosophic and reflective type of student and accents generalized thinking and abstract knowledge less heavily. These conclusions, however, must be modified by the fact that, as a rule, men of a different type take the co-operative courses. They are usually practically minded and develop "horse sense" and direct action through contact with industrial men during their college course. Their time is assigned to definite jobs which must measure up to commercial

standards. They have little time and less inclination for dealing with the philosophic values in life.

It is fortunate that there is no standardization in engineering education. Students and industry would not be best served by a single standardized type of program. The field of engineering is broad, and all well-considered schemes of education get worth-while results. The co-operative method can now be accepted as a thoroughly good and well-tried method of engineering education and on a par with other and older methods.

Where Is Our Commercial Courage?

THE Copper and Brass Research Association is now engaged in advertising electric wiring and rewiring to the homes in 68 cities of a population exceeding 10,000. Its message is being carried in 123 newspapers, and it is, at the same time, distributing broadly throughout the country an impressive and appealing booklet that tells the story of modern electrical equipment in the home. This campaign has probably excited more comment among electrical men than any other like event of recent years. The fact that the copper producers, to create a market for the mere raw copper that will go into the wire and fittings that better wiring jobs will need, should undertake this educational work that the electrical industry should be doing for itself is astonishing, when you look at it from the point of view of the electrical man.

The copper industry knows what it is about. Time was when galvanized gutters and downspouts were the standard, but educational advertising has "sold" the American people on the advantage of copper. Green-painted wire window screens were once the vogue, but today all the world wants copper. A few years ago only the millionaire thought of using brass water pipe, but now we see it riding to the job in any plumber's wagon. The copper and brass people are responsible for this, and what more natural, once these purposes are well on their way, than that they should be attracted to the undeveloped field for electric wiring? They have observed that there are almost 16,000,000 homes inadequately wired, and that the electrical industry is doing nothing about it in an organized way. So they are going after this abandoned market themselves.

Where is our commercial courage—we electrical men? When will we look about us and learn from other industries how to unite our strength in building markets?

Fifty Years Have Reversed the Economics of Artificial Lighting

MANKIND has the habit of dividing history into epochs, but in the history of civilization epochs are shortening. This is due to the increase in the rate of change, and in man's activities this rate is constantly accelerating, owing to accumulated knowledge and the consequent increase in the intensity of interest directed upon various phases of these activities.

The last fifty years is the epoch of electric lighting development, for this kind of lighting began only half a century ago. It is commonplace to remark that the cost of light today from tungsten-filament lamps is only a small portion of the cost of the same quantity of light fifty years ago; but how many grasp the enormous difference? If the unskilled laborer of a half century ago had used as much light as is now used daily in the average home in this country, he would have had to work two and one-half hours daily to pay his gas-lighting bill alone, as compared with approximately ten minutes daily for the average unskilled laborer to pay his present electric lighting bill. Of course, this great difference is due to the decreased cost of light, since the unskilled laborer now receives approximately $3.22 per day as compared with $1.43 fifty years ago. At the present time the average family is spending seven cents a day for electric light in the home. On the same basis of comparison, if the laborer a half century ago had used tallow candles to supply as much light in his home as he uses now, he would have been able to purchase nothing but light, and he would have had to labor almost twenty-four hours a day to pay for that.

Taking this line of reasoning into factories or other workplaces, it is seen that good artificial lighting of present-day standards was economically impossible fifty years ago. Good artificial lighting at that time was an expense so overwhelming that it would have dragged the worker and the employer to bankruptcy. But times have changed. Good lighting is now a worker for the workers and a producer for the employer. It pays for itself several times economically. Yet most homes, factories, offices and streets are underlighted from an economic viewpoint. This may be due to a lack of general recognition that the economics of artificial lighting have been reversed.

System Operators' Functions Are Assuming Executive Importance

UTILITY companies that think they have found the best methods of handling system operation may be in for surprises when they interconnect with other systems aggregating considerably more generating capacity if they try to continue their practices without regard to the experiences of interconnected groups. The most disconcerting outcomes of attempting to regulate frequency independently will take such forms as upset interchange contracts, overloaded tie lines, separated systems, disturbance of load distribution on the remainder of the system, and so on. Embarrassment may arise from the inability to adjust domestic electric timepieces where clock service is sold unless concerted action is taken by the interconnected group. The difficulties increase with the number of systems involved, the total interconnected capacity, the presence of a large number of water-power plants and the existence of improper governing.

Unless a system joining an interconnected group represents a large part of the total connected capacity, it will be impossible for that system to adjust frequencies unaided even by manipulating all its stations concurrently. If that system could swing the frequency, it would be inadvisable to do so independently of the connected systems because of the effects on power interchanges and because of the other disturbances enumerated. An obligation between each and every unit of a connected system arises the minute interconnection is effected.

Despite the fact that complexities in system operation arise when a number of systems are interconnected, the problem is not unsolvable. The solution will come through the general recognition of new conditions requiring new or modified methods and an agreement among interconnected companies as to how the system

operation shall be handled. This cannot be accomplished merely by executive or contractual agreement, but must be obtained by agreement among the system operators. Considering the increasing dependence of executives on system operators for maximum use of system investment, economy of operation, reliability of service and fulfillment of interchange contracts, every opportunity should be afforded system operators having related interests to discuss their mutual problems and determine their solutions, as is being done in New England, Pennsylvania and the Southeast; but similar meetings should not be limited to state boundaries.

So many problems and solutions are common to interconnection everywhere that great value might attach to a national clearing house devoted to system operating experiences and practices, which could co-ordinate system operation with other utility activities and particularly executive functions. Since system operation involves a consideration of executive, engineering and commercial policies, it would seem advisable to form a national committee which would be representative of all interests. Present committee activities in the rate-research, apparatus, prime mover and overhead-systems committees along lines of interconnection and interconnected system operation might well be co-ordinated and perhaps consolidated in a sub-committee of the N.E.L.A. engineering administration committee. The topic is of far-reaching importance and needs competent attention.

Commendation Moves Mountains of Indifference or Opposition

FROM an executive desk many miles away from the scene of system repair and reconstruction work it is easy to underestimate the influence of personality in economical and high-quality maintenance. The importance of modern equipment, tools and methods is widely recognized; the need of contentment among men in the field is also realized, but beyond these exist personal elements which are not always so evident in their effect upon the kind of work done, its cost and the outlook for improvement.

Recently the chief engineer of a large public utility reached the conclusion that undue emphasis had been laid upon criticism during his inspections of field work. He reversed his emphasis on his next trip over the property and began his inspection by looking for things to commend. Finding many such, the critical side of the visit was held in abeyance until its close, when attention was tactfully called to various possibilities of achieving better results under the conditions prevailing. The outcome of this change in approach was the stimulation of pride in excellent work all along the line and a new enthusiasm to accomplish results in prompt time and with economy in expenditure considering the quality of the performance. The plan has worked well for months, and at the same time nothing important has been overlooked in the way of executive suggestions for improvement.

This instance illustrates the point often made with much reason that labor of whatever rank seeks the satisfaction of pride and self-respect as well as material compensation in appreciation of good work by associates and superior officials. Recognition of this kind has as positive an economic value as analytical criticism and in combination with the latter may literally move mountains of indifference and opposition.

Charging Merchandising Losses to Operation

CLAIMING that a power company has no right to charge losses sustained in merchandising to operating expenses and, in fact, no right to merchandise at all at a loss, a merchants' organization in a Western state has filed a complaint with the state regulatory body seeking to have the classification of accounts changed which permits a utility to charge salaries and commissions and losses in merchandising to operating expense. The practice of charging merchandising losses, if such there be, to operation is common practice with most utilities, and is as justifiable, under the head of an investment for the development of market, as charging commercial expense or any other expense incidental to adding load to operation. Why the question should be raised in this case is not clear.

The only issue that has ever come up in connection with power-company merchandising is whether the merchandising department should be conducted at a profit and made to stand on its own feet or whether a power company is justified in selling appliances at a merchandising loss in order to obtain the greatest possible added revenue accruing from appliance load. This has been a matter which each individual utility has had to decide for itself. It is not conceivable that the regulatory body will uphold the dealers in their contention, for to do so would be to say that a power company does not have the right to spend the profit from the sale of an appliance, plus possibly all or a part of the first year's revenue, to obtain the load, which in turn is tantamount to saying that the universal practice of utilities in spending a part of the revenue to be derived from any piece of power or lighting business in adding that piece of business to its lines is also wrong. But it is only by aggressive load-building efforts, through the sale of appliances and the adding of power, lighting and heating load, that central stations have been able to increase their gross revenue, improve their system load factor and keep down the rates charged to consumers in the face of higher prices for labor and material.

Many utility executives hold to the view that no part of the revenue from ranges and appliances should be used to help defray the expense of securing this type of load, yet they justify expenditures up to six times the annual revenue to obtain other classes of business. This has been the underlying reason for the stagnation of some utility commercial organizations. Their hands are tied and yet they are expected to produce results in the face of this discrimination against the appliance load.

The same need exists for the investment of money in the educational development of the market for various appliances during the period of pioneering and before they are sufficiently salable for the merchandising profit to be adequate to cover the cost of selling. There is this difference between appliance sales and motor sales, however. Many other merchants are engaged in the appliance trade, and these electric and non-electric dealers are dependent upon merchandising profit alone for their prosperity. They cannot look to future income to recoup merchandising losses. Strictest care should be exercised, therefore, by the utility to maintain a fair competitive standard of prices. This done, no merchant who understands the purpose involved will ever object if the public service company spends more than its profit in market building, for every dealer benefits in the resulting increased trade.

Clarence L. Collens

A manufacturing executive whose leadership has helped shape the progress of the electrical industry.

FEW men of the electrical industry have seen written to their credit as notable a record of service as Clarence L. Collens, president of the Reliance Electric & Engineering Company of Cleveland. For years he has been prominent as the executive head of one of the outstanding manufacturing companies in the motor field, but his activities as an organizer in the apparatus industry itself have brought him even wider recognition. Seeing the need for a practical co-ordination of policies and standards, he entered heartily into association work and the prestige of his success in the operation of his own company gave weight to his opinion. Gradually his qualities of leadership brought him expanding responsibilities, first in the power group and later in the broader affairs of the manufacturing industry. A tireless worker for a closer co-ordination between the associated groups, by the influence of his enthusiasm, energy and sound judgment, combined with rare qualities of patience, diplomacy and perseverance, he has carried this ideal and purpose steadily forward.

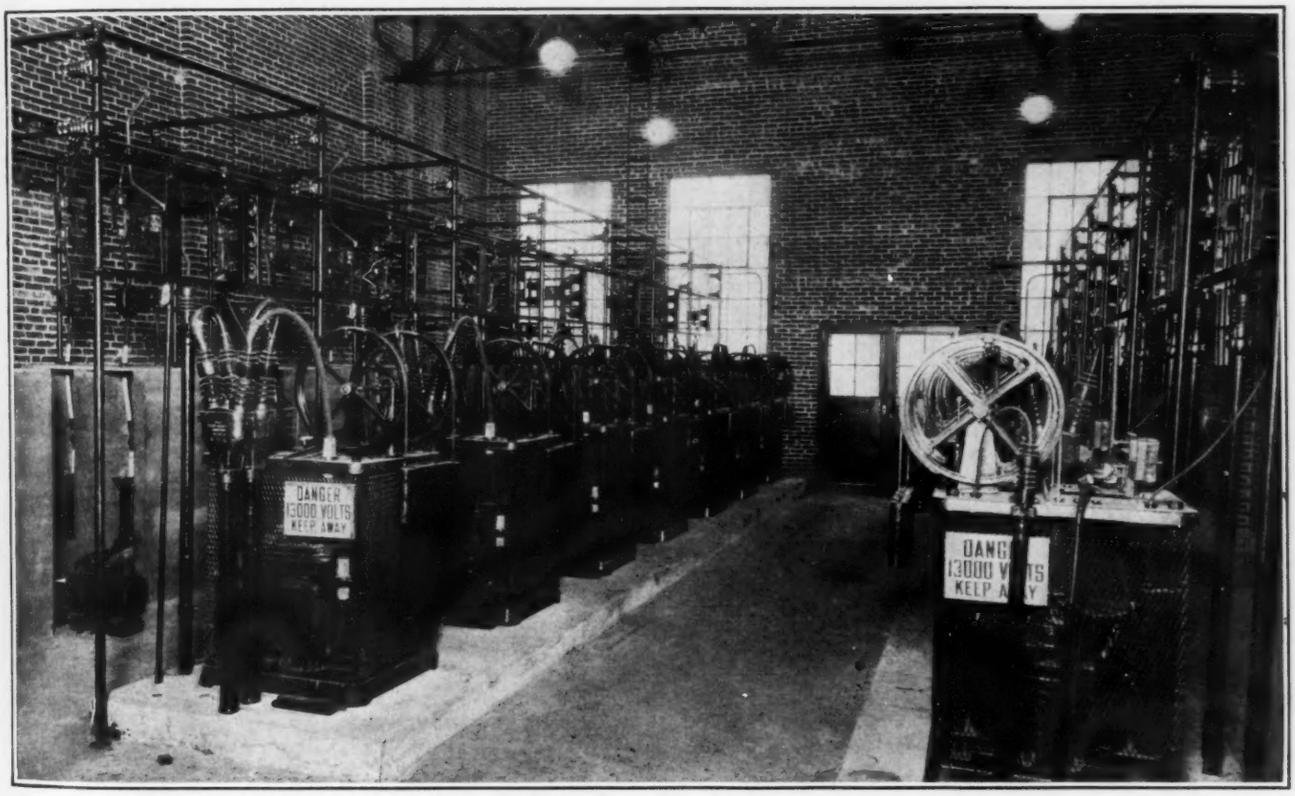
Notable among his achievements, as chairman of the Electric Power Club committee on ratings, he was influential in effecting a solution of the long-standing controversy over temperature ratings in electric motors and in reconciling this adopted standard with the viewpoint of the National Electric Light Association. More recently, as chairman of the Electrical Manufacturers' Council, realizing the advantages to be gained by an actual union of the separate associations of electrical manufacturers, he brought about the organization of the National Electrical Manufacturers' Association, embracing the manufacturers of apparatus, supplies and radio. For this the James H. McGraw medal was awarded to him in 1926. He at present presides over the executive or "Policy Division" of the association, of which he is a vice-president and director.

Mr. Collens was graduated from Yale in 1896 and took a post-graduate course at Columbia, after which he joined the Hartford Electric Light Company. He later became vice-president and general manager of the Acheson Graphite Corporation at Niagara Falls, which he later left to take the presidency of the Reliance company. He is a member of the National Electric Light Association. He is a past-president of the Cleveland Engineering Society, president of the Association for Crippled and Disabled of Cleveland, and a member of many associations and clubs.

Automatic Substations Control St. Louis Street Lighting

City Is Divided Into Districts, Each Served by a Substation—Equipment Layout Is Described and Sequence of Automatic Functions Is Explained

By E. Vernon Ellett
Switchboard Engineer Westinghouse Electric & Manufacturing Company



CONSTANT-CURRENT REGULATORS AND FEEDER BUS IN ONE OF ST. LOUIS' AUTOMATIC STREET-LIGHTING SUBSTATIONS

THE importance of an adequate street-lighting system has not been overlooked by the city of St. Louis, Mo., in its municipal program. Eight million dollars of the bond issue funds will be devoted to a comprehensive street-lighting installation covering the entire city. After three years of research and development work a system has finally been adopted embodying many new and unusual features, one of the most interesting of which is the system of automatic control for the substations supplying energy to the system.

With the idea of securing the highest continuity of service, the city was divided into districts, the street-lighting circuits in each district being controlled by an automatic substation centrally located in the district. The contract for the first section of the new system was awarded in December, 1925, and the section completed by the contractor in December, 1926, in 208 working days. This installation comprises equipment for three districts, B, C and D. The B district substation, which governs the street lights over an area of approximately three and one-half square miles, controls 3,918 standards with a total load of 461.19 kw., and substa- governing an area of three square miles, controls 3,446 standards with a total load of 461.19 kw., and Substation D, delivering 417.94 kw., controls 1,977 standards, extending over a district covering one and one-half square miles.

Equipment Layout and Arrangement

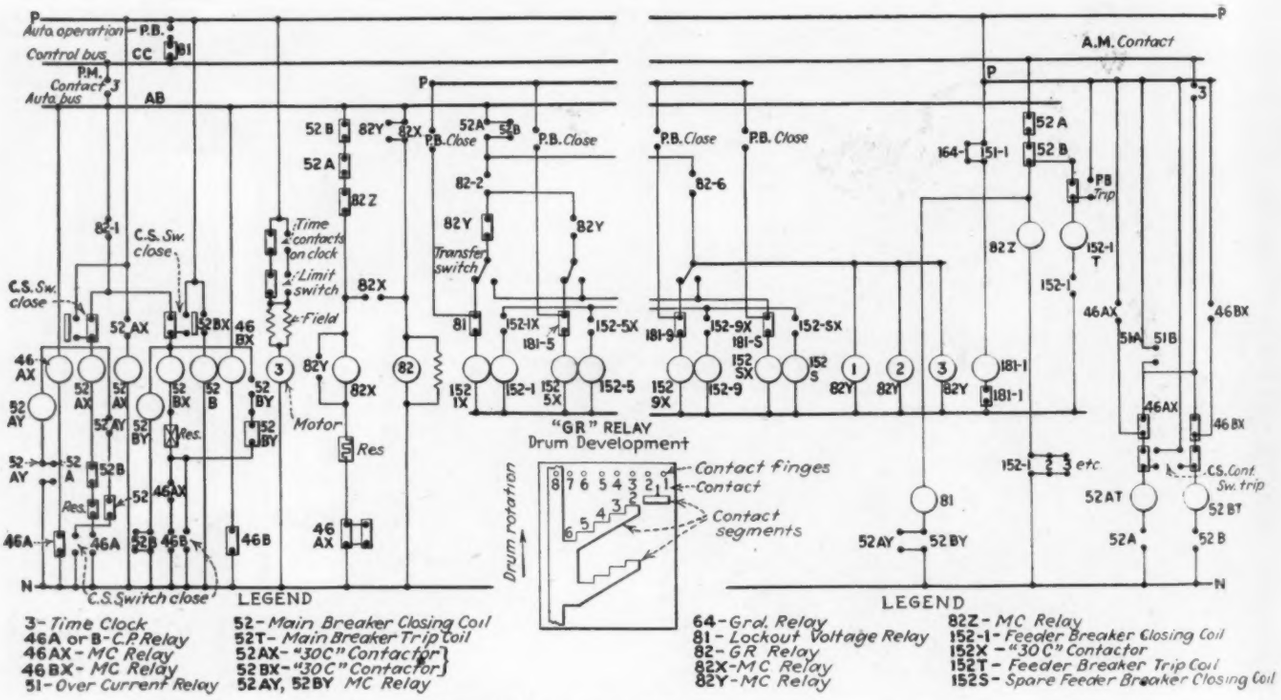
Each substation is fed by either of two 13-kv., three-phase power lines of the Union Electric Light & Power Company to minimize the possibility of a district being without lights due to a power-line failure. Under automatic operation one line serves as a preference line, being connected to the station bus during demand hours if balanced three-phase voltage is available, and the other serves as a standby, being automatically con-

nected to the station bus upon failure of voltage on the preference line. The station bus feeds the primaries of 50-kva. constant-current regulators, station B having fourteen of these regulators and stations C and D each having twelve. Two of these regulators, together with an electrically operated oil circuit breaker, disconnecting devices and control apparatus, form a feeder unit. The primaries of the two regulators are connected in parallel, and the secondaries are connected in series to feed a group of series circuits, which are grounded both at the junction of the regulator secondaries and at the various load centers. Each regulator delivers a constant current of 20 amp. at a normal voltage of 1,500 volts.

The equipment for each substation is of the indoor type. The incoming-line equipment is located at the north end of the building. Connections from the two incoming-line conduits run to disconnecting switches mounted in cells at the rear of the corresponding circuit breakers. The breakers, which are also cell-mounted, are 600-amp., 15-kv., three-pole, electrically operated type OE-6 units having their operating mechanisms mounted above the switch cells. Directly above the mechanisms are six compartments housing the potential transformers. Four of these transformers, two for each line, are connected to the line terminals of the breakers. Their secondaries operate polyphase voltage relays, which, for automatic operation, select the line that shall be connected to the station bus. The remaining transformer compartments house the power company's potential transformers for the station watt-hour meter. Current transformers and disconnecting switches for isolating the breakers from the station bus are located in cells directly above the incoming-line disconnecting switches. Type CO relays connected to the secondaries of the 50/5-amp. current transformers furnish station overload protection. For the station bus there are provided 200-amp. choke coils and a three-phase type SV lighting arrester. They are situated above the incoming-line breaker structures.

The station bus runs along the east side of the station directly above the feeder oil circuit breakers, which are 400-amp., 15-kv., double-pole, single-throw, electrically operated type F-33 units. These breakers are mounted in separate cells with liberal spacing, the breaker mechanisms being outside the cells for ease and safety of inspection. The disconnecting switches and current transformers are directly above each breaker.

The breakers are so connected to the station bus as to balance the load as nearly as possible. The secondaries of the current transformers operate type CO relays, which trip all breakers for a feeder fault and "lock out" the breaker governing the faulty feeder.

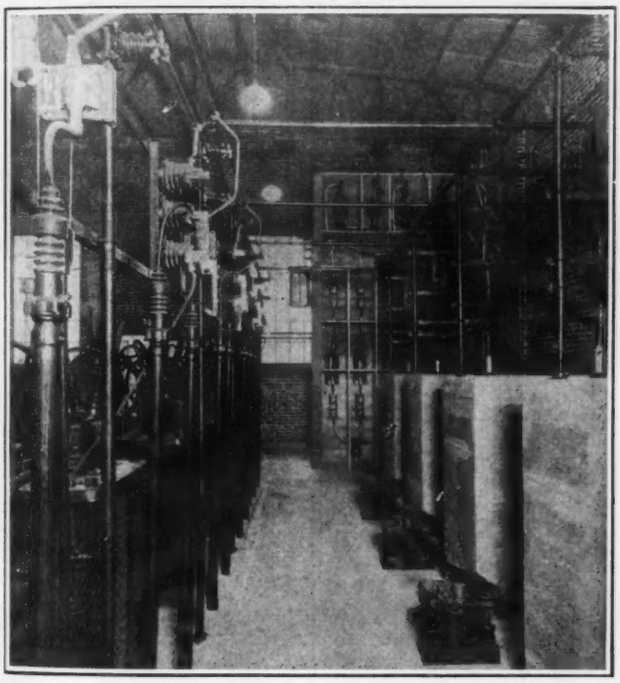


SIMPLIFIED LAYOUT OF AUTOMATIC CONTROL FEATURES

The constant-current regulators are arranged in two rows in the center and west sections of the station, each pair of regulators being in line with their governing breaker. They are so placed that their regulating weights are in the aisleway, thus affording maximum convenience and safety. Since the regulators are for automatic service, it has been necessary to provide them with stops to limit the rush of current incident to the closing of the primary circuits. A current transformer is connected in each regulator secondary circuit. The secondaries of these current transformers energize the metering elements of multi-pen recording ammeters, there being a separate element for each regulator circuit. Receptacles through which these circuits pass allow a check to be made of any one of the meter elements. A ground relay with contacts paralleling the feeder overcurrent relay contacts is mounted on each regulator frame, the regulator ground connection being through the coil of this relay.

One complete feeder unit is held as a "spare" in each station. One of the secondary leads of each service regulator goes directly to the station ground bus. The other lead goes to one of the jaw contacts of a double-pole disconnecting switch. The hinge contact of this switch is connected to one side of a feeder loop, the other jaw contact being connected to one leg of a transfer bus. This transfer bus may be energized by the spare feeder unit, and in case of a fault on any service unit the "spare" may substitute for the faulty service unit. By similarly connected knife switches on the switchboard, the control of the spare unit may be substituted in the automatic sequence for the control of the feeder unit it is replacing.

Control voltage (125 volts direct current) is supplied by a trickle-charged storage battery. The station lights



CELL STRUCTURES FOR INCOMING LINE AND FEEDER BREAKERS

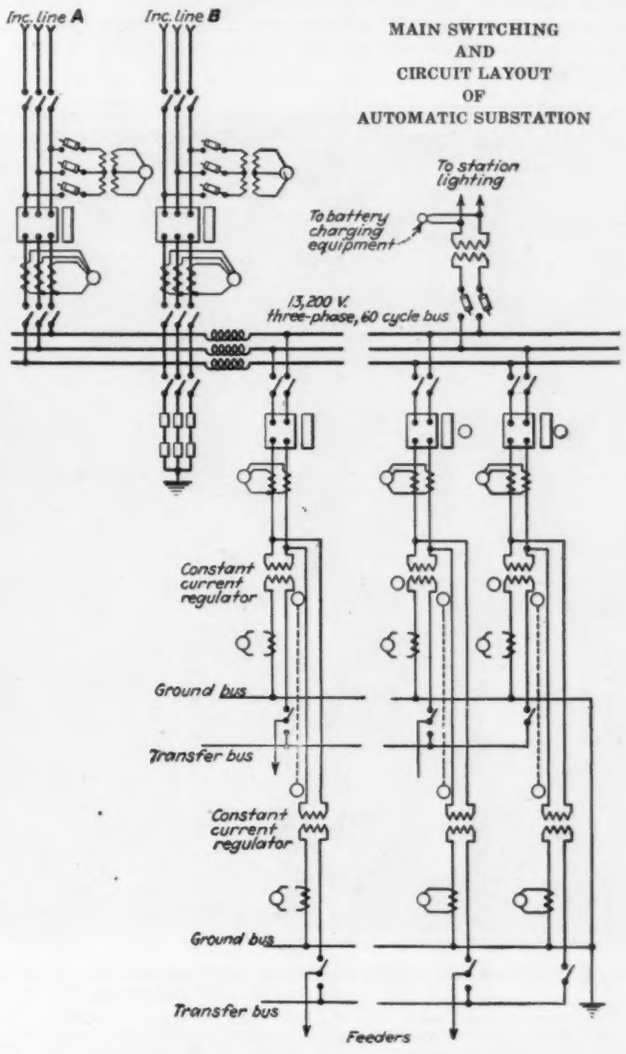
and battery-charging rectifiers, which are operated at 110 volts alternating current, are fed by a 5-kw. single-phase transformer connected to the station bus.

The times at which the station is put into service in the evening and disconnected in the morning are governed by a master time switch. This switch is equipped with an astronomical dial and varies the time of switching, morning and evening, with the seasons. It is of very accurate mechanical construction and is equipped with a motor-operated winding and switching mechanism.

From the schematic diagram it will be observed that a switch is supplied for making the station operation automatic or non-automatic. When it is in the non-automatic position, the station breakers can be closed by hand for inspection or other purposes as desired. When in the automatic position, the station becomes fully automatic and the sequence of operation outlined herewith takes place.

SEQUENCE OF AUTOMATIC OPERATIONS

Turning On Lights.—As soon as the time for switching on the light circuits is reached, the "p.m." contact on the master time switch 3 closes, energizing the automatic bus *AB*. This starts the automatic closing operation, the first step of which is to check whether all breakers are open. If they are and balanced three-phase voltage is available over one incoming line, an auxiliary multi-contact relay, 82*X*, operates and seals itself in. This results in the starting of the master sequence relay 82. This type GR relay consists of a motor driving a contact drum, the development and initial position of which are shown in the schematic diagram. After about five seconds, the segment bridging fingers 1 and 2 makes contact with these



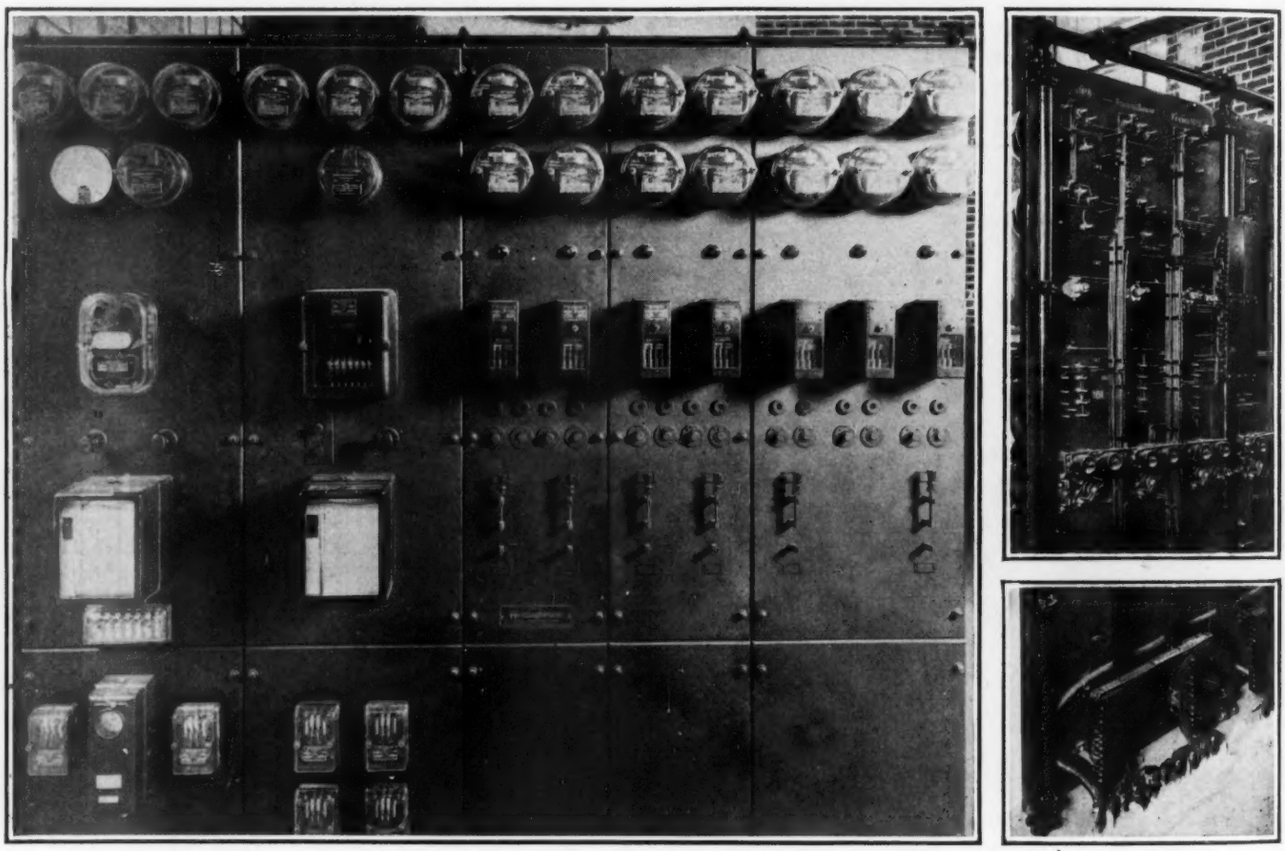
fingers, resulting in closure of the contact designated as 82-1. The incoming line-*A* breaker control relay 52-*AX* then operates to close line-*A* breaker, 52-*A*, if there is voltage on the line, which fact is indicated by the making of the front contact on the polyphase voltage relay 46-*A*. If voltage is not present on line-*A*, the line-*B* breaker control relay 52-*BX* operates to close line-*B* breaker, 52-*B*.

Upon the closing of either of these breakers the station bus becomes energized and the sequence for closing the feeder breakers begins. The master sequence relay continues to rotate, and after about five seconds contact 2 on the relay closes. This results in the operation of the first feeder-breaker control relay. The circuit for this relay comes from the automatic bus through the two incoming-line breaker "make" auxiliary switches connected in parallel, contact 82-2 on the sequence relay, a back contact on auxiliary relay 82-*Y*, the knife-blade transfer switch, a back contact on the feeder-lockout relay, the relay coil and thence to the negative bus. Feeders 2, 3, 4 and 9 are closed in like manner at five-second intervals by contacts 3, 4, 5 and 6 on the sequence relay. Contact 82-6 also picks up the 82-*Y* auxiliary relays, thereby transferring the action of the sequence relay to a second group

of feeder units. The sequence relay is thus able to control a total of nine feeder breakers through five drum contacts by utilizing these contacts a second time. Five seconds after the making of contact 6, contact 2 is again made, resulting in the closing of feeder 5, the 82-*Y* "make" contacts now being closed. In a similar manner feeder breakers 6, 7 and 8 are closed by the second making of contacts 3, 4 and 5 on this relay. The operation of the 82-*Y* relays also results in the shunting out of the auxiliary relay 82-*X*. Hence as soon as contact 6 on the sequence relay is broken it stops rotating, it then being in its initial position. If the transfer switch for any feeder is thrown to the "down" position, the spare feeder immediately takes that feeder's place in the automatic sequence of operation.

equipment the incoming-line breaker is reclosed after five seconds. If the fault has been cleared, the feeder breakers are closed. If the fault remains, the line breaker is again tripped and the station is locked out of service by the operation of the bus-lockout relay 81.

Upon occurrences of a fault on any one of the feeder circuits, reflected by operation of the type CO overload relay or the ground relay, the lockout relay for the feeder in trouble is operated and the incoming line breaker feeding the station is tripped out. The feeder breakers then trip as at the making of the "a.m." contact. Since the "p.m." bus is still energized, the automatic equipment goes through its regular starting sequence, so that the faulty feeder remains locked out until the lockout relay 181 is reset by hand.



AT LEFT, AUTOMATIC-CONTROL RELAYS AND METERS ARE ON THIS BOARD. AT RIGHT, BACK-OF-BOARD WIRING ON PORTION OF ONE PANEL AND TERMINAL BOX CONNECTIONS AT BOTTOM OF PANEL

The control equipment for the incoming lines, together with the master-station equipment such as the electrically operated time switch, multi-pen recording ammeters and master sequence relay, is located on panels 1 and 2. The individual control equipment for each feeder unit, consisting of two type CO overcurrent relays, one green signal lamp (denoting "lockout" of the feeder), one auxiliary latch-type lockout relay, two ammeter receptacles (one for each leg of the loop circuit), "trip" and close push buttons for manual operation, and one single-pole, double-throw knife switch, is mounted in a vertical line.

Shutting Off Lights.—The making of the "a.m." contact on the clock, signifying that it is time for cutting off the street lights, results in the tripping of the line breaker then feeding the station. The feeder breakers are tripped, their trip coils being energized from a common bus energized by "break" auxiliary switches on the incoming line breakers connected in series.

Voltage Interruption.—If at any time during the night voltage fails on the incoming line feeding the station, the back contact on the voltage relay is made, thus picking up the auxiliary relay 46-*AX* or 46-*BX* and tripping all breakers in the sequence followed at a morning shut-down. The station is then in the same position as at the making of the "p.m." contact, and if voltage is available on the other line, the closing sequence outlined above is repeated, bringing in the other incoming line.

Effect of Bus and Feeder Faults.—If a bus fault develops during a service period, the operation of the *CO* overload relays for the incoming line then feeding the station causes the tripping of all breakers. Through the master sequence

Manually operated control switches for closing and tripping are provided for both the incoming line and the feeder breakers. After placing the master station push button in the non-automatic position any or all breakers can be closed or tripped at will. The manual control circuits are so interlocked as to prevent impulses being transmitted to circuits other than the one being controlled.

Summarizing, under automatic operation the station master switch is placed in the automatic position. Then upon the making of the "p.m." contact on the time switch a check is made for voltage on both incoming lines. The preference line is connected to the bus if there is voltage on that line, and if not, the standby line is connected. After one line breaker is closed the feeder breakers are closed in order at five-second

intervals, thus keeping system disturbance at a minimum. Upon a loss of voltage on the incoming line feeding the station, that line is opened and the feeder breakers are tripped out. If voltage is present on the other line, the regular order of closing sequence is carried through connecting the live line to the station bus. Upon the occurrence of a feeder fault the incoming line breaker and all feeder breakers are tripped out. The faulty feeder circuit is locked out and the other circuits are closed in the regular sequence. Upon the making of the "a.m." contact all station breakers are tripped, leaving the automatic equipment in the proper position to function upon the next making of the "p.m." contacts on the master time switch. By means of double-throw disconnecting switches spare feeder equipment may be substituted for any service unit, and by double-throw knife switches the spare feeder can be made to function automatically in the place of the unit it is supplanting. Manual switches enable the closing or tripping of any breaker for inspection or other purposes.

From the foregoing description of apparatus and sequence of operation it is seen that each substation in the system is a self-contained and self-regulated unit functioning to serve its district under all conditions in such a manner as to give dependable regularity to all operations and to limit and reduce the time of outages.

Action Urged on Standardization

Agencies Engaged in Standards Work—Controversial Situations Indicated—Need of a National Perspective and the Development of a Centralized Authority

By L. W. W. Morrow
Managing Editor Electrical World

STANDARDIZATION is a new and outstanding influence in modern industry. It is based on an economic conception of utility, and its trends and ramifications affect every aspect of design, production and utilization. It is a precision process based on agreements of authorities armed with knowledge, and its success or failure is measured in terms of economic savings.

Intense activity in standardization characterizes all industry. There is an incessant struggle for new standards and for the adoption of standardization as an active business principle. Enormous incentives are at hand to bring order, simplicity and efficiency out of chaos, chance and waste. Even the word "standard" has come to mean many things. It applies to commercial contracts, to commodity specifications, to test rules, to fire and safety codes, to technical constants and definitions, to the metrics of verse and to the proportions and dimensions of apparatus and structures.

A multitude of international, national, state, city and business agencies are engaged in the making of standards. Whether the standards concern themselves with rules of conduct, measurements, scientific constants, quality specifications, performance characteristics or codes of practice, there seems to be an economic incentive for many units of civilization to embark upon a voyage of standardization.

A fairly complete list of agencies engaged in standardization work in this country is given in the following table:

191 Trade and commercial associations.
17 Professional and technical societies.
54 United States government bureaus.
81 State highway commissions and other state bureaus.
105 City government bureaus or departments.
5 National standardizing organizations.
2 American committees of international standardizing agencies.

The electrical industry may be used as an example of the multitude of standards-making organizations found in each branch of industry and in governmental departments. The following 30 agencies make electrical standards:

American Bureau of Welding.
American Electrochemical Society.
American Electric Railway Association.
American Institute of Electrical Engineers.
Association of Electragists, International.
Association of Edison Illuminating Companies.
American Welding Society.
American Physical Society.
American Electroplaters Society.
Association of Iron and Steel Electrical Engineers.
Association of Railway Electrical Engineers.
National Electric Light Association.
Electrical Supply Jobbers Association.
Electrical Safety Conference.
Elevator Manufacturers Association.
Illuminating Engineering Society.
Institute of Radio Engineers.
Radio Manufacturers Association.
International Association of Municipal Electricians.
International Brotherhood of Electrical Workers.
National Association of Electrical Inspectors.
National Association of Railway and Utility Commissioners.
National Electrical Manufacturers Association.
Federal Power Commission.
National Board of Fire Underwriters.
National Association of Fixture Manufacturers.
National Fire Protection Association.
National Lightning Rod Managers Association.
United States National Committee of the International Electrotechnical Commission.
Western Association of Electrical Inspectors.

Closely allied to the electrical organizations is a group which is making standards that affect the electrical industry. The following fourteen organizations are typical:

American Society for Testing Materials.
American Ceramic Society.
American Institute of Chemical Engineers.
American Society of Mechanical Engineers.
American Wood Preservers Association.

Copper and Brass Research Association.
National Varnish Manufacturers Association.
National Safety Council.
Rubber Association of America.
Society for Promotion of Engineering Education.
United States Bureaus in Several Departments.
Federal Specifications Board.
American Engineering Standards Committee.

In the realm of international standardization this country must deal with ten agencies, any one of which may engage in electrical standards work. These agencies are:

International Bureau of Weights and Measures.
Inter-American High Commission.
International Astronomical Union.
International Commission on Illumination.
International Electrotechnical Commission.
International Standards Association.
International Union of Pure and Applied Chemistry.
International Union of Scientific Radio Telegraphy.
Pan-American Standardization Conference.
Olympic Games Committee.

Typical of the 44 governmental standardization organizations in the several departments and aside from the work of the Federal Specifications Board, which was established in 1921 and has issued 450 mandatory specifications for government purchases in 40 departments, are the following bureaus in two of the departments:

Department of Agriculture:	Department of Commerce:
Bureau of Agricultural Economies.	Bureau of the Census.
Bureau of Animal Industry	Bureau of Fisheries.
Bureau of Chemistry.	Bureau of Foreign and Domestic Commerce.
Bureau of Plant Industry.	Bureau of Lighthouses.
Bureau of Public Roads.	Bureau of Mines.
Forest Service.	Bureau of Standards.
Weather Bureau.	Steamboat Inspection Service.

Work Often Duplicated

It is evident that with this multitude of uncoordinated agencies there will result much overlapping of work and much duplication of effort. Even with the co-ordination possible in the American Engineering Standards Committee the following incomplete list of standards projects with their sponsors gives evidence of lack of rhyme or reason for many sponsorships if the proposed standard is to be used freely by all electrical or industrial organizations and is made by a representative group of men:

Electrical Properties of Aluminum—A.I.E.E.
Properties of Electrolytic Copper and Copper Wire—A.S.T.M.
Insulated Wires and Cables—Ten organizations.
Coal Mine Illumination—Bureau of Mines.
Lighting Factories, Mills and Other Work Places—I.E.S.
Wood Pole Specifications—A. T. & T. Co.
Tubular Steel Poles—A.R.A.
Miscellaneous Line Materials—N.E.L.A.
Manhole Frames and Covers—A.S.C.E. and A. T. & T. Co.
National Electrical Safety Code—Bureau of Standards.
National Electrical Code—Electrical Safety Conference.
Code for Meters—N.E.L.A., Bureau of Standards, Association of Edison Illuminating Companies.
Lightning Protection—A.I.E.E., Bureau of Standards.

American Engineering Standards Committee

The American Engineering Standards Committee was started by the engineering societies as a sort of clearing house for standards-making agencies, but the center of gravity for its work has passed to trade associations. The main committee has nineteen trade associations, nine technical societies and seven government departments represented. Ninety American standards have been approved and 140 others are under way. The organization is highly decentralized and work moves slowly. With literally hundreds of organizations promulgating standards, with little or no systematic co-operation, there is great difficulty in doing a national job on standards.

At every stage of the work the attitude is frequently met that a group feels sufficient unto themselves and they can see no necessity or even advantage in co-operation with other interested organizations. Also in many cases strong organizations have felt that they had vested interests that would be jeopardized if they co-operated too freely in a broad movement. Many have felt that in so doing there was danger of losing some of the proprietary features of their standards and incidentally losing their prestige. This has been equally true of trade associations, technical societies and federal agencies. Inertia, lack of interest and understanding of the needs of national standardization and of its economic effects have characterized the executives in all industries.

These are fundamental conditions encountered by the A.E.S.C., which have to be faced in dealing with the national standards problem.

Cost of Standardization

It is estimated that about $8,000,000 was spent in 1926 for standardization work in this country. This was divided about as follows: Federal government, $4,250,000; trade associations, $3,000,000; technical societies, $830,000, and the states, $145,000. The American Engineering Standards Committee spends about $58,000 a year.

Multiplicity of Agencies

The foregoing outline shows that in all industry several hundred organized groups are doing standardization work of some kind. In the Commodity Specification Book of the Department of Commerce, for example, there are 27,000 listings of standards dealing with 6,000 commodities. Many of these were formulated by a single organization. In many cases there are ten to 40 specifications for the same commodity. This citation is typical of conditions.

While the pioneering work on standards has been done by technical societies and government departments, trade associations have already become the most important factor in the movement. The reason is that standardization involves managerial decisions and commercial competitive policies. Management, therefore, demands a seat at the council table.

Two fundamental positions have been crystallizing out in industry among standardizing agencies with respect to the method of formulating standards. The electrical industry situation may be used as an illustration of these two positions. The one position is that which has been taken by the board of directors of the American Institute of Electrical Engineers, which is to the effect that the professional engineering society should control both the fundamental standards and those applying to commercial products. The advocates of this plan are following out the traditions of the A.I.E.E., which has, perhaps, more than any other professional organization carried on standardization and secured a place in industry through its work at a time when the trade association had not yet arisen to a position of influence in the industry. The plan pro-

posed by Mr. Chesney at the midwinter convention of the A.I.E.E. is in line with the work and traditions of the institute, except that he has suggested a definite number of members of the standards committee, some of these to be nominated by two of the numerous electrical trade associations.

CHESNEY PROPOSAL NOT NEW

In the past trade associations have been asked to send members, but no definite number has been named, and they were not officially nominated by their organizations. Otherwise the scheme is essentially that which has been in force in the institute for a number of years. Mr. Chesney has changed from the plan of a small executive committee with a large number of active working committees, which was adopted when the old scheme of one central committee became unwieldy on account of the increase in the number of members to conform to the need for a representative committee. The advocates of this plan feel that the work done under a professional engineering society would be entirely free from commercial bias and that the prestige of standards thus developed will be such that all parties at interest will be glad to accept them.

Another general plan which has been accepted by the American Society of Mechanical Engineers and by the American Society for Testing Materials, a semi-professional engineering society, and which has found favor with many other industry groups, is that the professional engineering society act as sponsor or chairman of the groups interested in the formulation and use of standards, bringing in all parties at interest in an official manner during the period of formulation instead of submitting complete standards to a sectional committee if and when it was desired, with the expectation that the other groups will rubber stamp the standards so formulated.

The adoption of such a plan necessarily would mean a considerable change in the method that has hitherto been followed by the A.I.E.E. It is a procedure that provides a means of bringing about the formulation of a standard in such a way that, when the standard is completed, it is of necessity accepted by all parties at interest. Such a method will probably consume more time for the formulation of a good standard than the scheme of having a smaller group in a professional society carry on the work, but when completed, a standard formed by the latter method frequently requires to be sold to industry, so that the total time between the initiation of a standard and its acceptance by industry may be greater than when formulated under the equivalent of A.E.S.C. sectional committee procedure.

Each method has certain inherent advantages and certain disadvantages. The experience of the last five years has shown that the complete control by the professional society is a constant source of frequent and sometimes bitter controversy, due to the fact that the trade associations (manufacturers and users) are the ones that must of necessity administer the standards formed and they feel very strongly that they must have official representation, usually with instructed delegates. This is particularly true of those associations in which the acceptance of a standard becomes mandatory on the part of all groups belonging to the association.

It is true, as contended by the advocates of this plan, that the trade association has ample chance of vetoing standards it does not approve when they are submitted to the A.E.S.C. for acceptance as American standards. The trade associations, however, desire something more than mere veto. They desire a positive part in the making of these standards. Experience during the last few years has shown that lacking the positive place in the making of the standard, there is a very strong tendency for the trade association to play politics when such standard is submitted as an American standard in order to jockey for a place and for the insertion of changes of requirements which should have been threshed out and settled before the standard was originally adopted. If the trade association were willing whole-heartedly to turn over the standards-making job to the professional society, the whole problem would be solved, but unfortunately this seems to be out of the question.

The sectional committee plan, under the auspices of the A.E.S.C., is of more recent origin than the making of standards by the professional engineering societies with unofficial representation on the part of trade groups. This plan has been growing very markedly in favor in many quarters during the last eight years. Various difficulties have arisen in the administration of this plan, largely because the A.E.S.C. lacked money, authority and personnel. This plan is particularly valuable in groups such as the electrical group, where there are several interests involved that have distinctly different viewpoints, resulting as it does in the final production of a standard that can be denominated truly an American standard, with all its provisions agreed to by all parties at interest before any attempt is made to pass it as American standard. It eliminates overlapping jurisdiction, which is inevitable when two or more groups attempt to make standards on the same subject, even though they originally started out to cover different parts of the same field.

This plan has been successful in a number of industries, and as a specific example might be cited the 25 sponsorships accepted by the A.S.M.E. There is a cordial acceptance from the A.S.T.M. of this plan; it has already brought many of its projects under sectional committee procedure and expects eventually to place all its work on a sectional committee basis. The National Electrical Safety Code, formerly a proprietary code of the Bureau of Standards, and the National Electrical Code, formerly a proprietary code of the National Fire Protection Association, are now both under sectional committee procedure, and this has given them a standing that in law and in fact would be impossible with any proprietary code. The production of a large number of safety codes under this procedure is going on with very great satisfaction to those who must administer and use them. In fact, this safety code work would be almost impossible except under a procedure equivalent to that of sectional committee procedure. Those who have advocated official recognition of the trade associations in standards making have not at any time advocated the fundamental control of standards by those associations, except a possible few, who feel that their group should make its own standards regardless of any other group.

CENTRALIZATION OF AUTHORITY NEEDED

The standardization situation in any branch of industry must be considered in the light of all national and international standardizing conditions. With a large number of agencies engaged in standards work, there is no alternative to the adoption of fundamental business principles that have been found successful in other lines of industrial activity. One sound principle is the use of

centralized authority in the person of an able executive who is assisted and advised by a small but able executive committee.

The fundamental conception of standardization is that standards shall fit industry conditions and be unanimously accepted. A new standard should be made only when there is economic justification for its use. Other considerations are that standards should be made by competent men and should be changed quickly when conditions justify revisions.

Full initiative in the adoption of a standard should be left to any industry group and the *power of veto should be absolute to protect all organizations represented in the standards-making body.* But when any group in any industry starts to make a standard there should be available a national standards executive who, aware of the proposed standard, can survey the national and international situation and help guide and expedite the development of the standard so that it will fit industrial needs.

As a hypothetical organization the following national executive committee of six unsalaried men may be considered logical:

The president of a professional society.
The president of a trade association.
An industrial executive of national prominence.
The Secretary of Commerce.
The president of the United States Chamber of Commerce.
An appointee of the President of the United States.

Further, assume an able man is appointed as national Director of Standards with an adequate salary and is aided by an able Assistant Director and a small office staff. The initial cost for salaries and office supplies can be assumed to be about $125,000 per year.

With such a national centralized agency to deal with procedure and policy in standards making, it is reasonable to assume that results could be had. Suppose any group in any industry sets out to make a standard. The national Director of Standards steps into the picture immediately and by means of available contacts measures the necessity for the standard and determines whether it affects more groups than the one starting the project. If the proposed standard is needed and does not affect other groups, then the group initiating the standard carries it through to completion as a national standard.

But suppose a proposed standard affects two or more groups or is international in its ramifications. In this case the national Director of Standards may call a conference of interested parties to discuss the scope of the standard, to measure its value and to formulate a list of names of men who are considered competent to make the standard. Then, with the advice of the national executive committee when advisable, the national Director of Standards appoints a competent committee composed of official representatives of all groups interested in the standard and this committee carries the standard through to completion. The standard then is an American standard without further formality. The national staff makes no standards, but merely centralizes the executive function and expedites standards making by direct acting committees or groups.

Also, under the direction of the executive committee, the national Director of Standards would

1. Collect and administer funds for the work of standards making.
2. Develop national publicity in regard to standardization.
3. Interest groups in industry in standards making so that needed standards will be started.
4. Map out the field and co-ordinate national and international standards work.
5. Help get adopted standards put to use in industry.

The foregoing proposal is merely indicative of the kind of plan that has been found successful in modern business. Present conditions are far from satisfactory as regards policy and procedure in standards making. Large and cumbersome committees, partisan disputes as to jurisdiction, a lack of centralized authority, an overlapping of efforts, inadequate means, an ill-chosen personnel and other factors inherent in standardization activities by unco-ordinated groups sadly handicap procedure and mar accomplishments. If standards are worth while, which no one doubts as a principle, then industry attention should be focussed on the national and international situation in order to bring about an orderly and businesslike method for handling the situation. Standardization is far beyond the stage where a conglomerate of loose and cumbersome voluntary committees can function effectively.

British to Finance Hungarian Electrification Scheme

THE Hungarian government has submitted to a special commission of experts a number of plans for electrification drawn up by a financial group. The chief of these plans provides for the construction of a station to supply 100,000 hp. It is proposed to erect this station in the neighborhood of a coal-mining district where coal of inferior quality could be used under the boilers. The energy could be transmitted to industrial and manufacturing establishments of Budapest, as well as to the Hungarian section of the Budapest-Vienna railway line, 115 miles long, which is to be electrified. The total cost is estimated at about $15,000,000, the bulk of which would, according to the plans, be found by the British group, which proposes to take advantage of state aid offered by the British trade facilities act. The proportion of the British share in the costs is at the present time the subject of further negotiations. A state corporation has been founded for the purposes of carrying out these plans.

Transformer Oil Recovery in Germany

INSTEAD of wasting, or using for auxiliary purposes, the large amount of transformer oil which in course of time becomes unusable, the Allgemeine Elektricitäts-Gesellschaft considers that, if it can be suitably regenerated, such oil should be used again for its original purpose. To this end there has recently been installed in the A.E.G. transformer works in Berlin a plant for the regeneration of transformer and switch oils in which the oil is not only treated with china clay or similar substances, but undergoes a regular refining process; that is, the oils are treated with similar materials to those used in refining new oil. Transformer or switch oil that has become useless, acid or black is by the regenerative process rendered utilizable, of high value, light in color and with properties which do not differ substantially from those of completely new oil. The regenerating costs are fixed, so that, taking into account the scrap value, the wear and tear and the transport, it is claimed a definite saving is obtainable.

High-Speed Excitation for Stability*

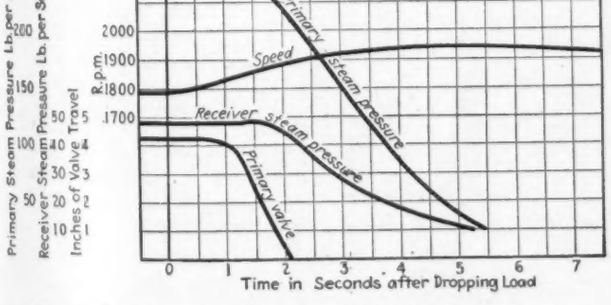
Reduction of Over-All System Phase Angle Important from Standpoint of Stability—Situation Reviewed in Which Special Design Characteristics of Machines Have Been Decided Upon—Developments in Regulators Explained

ON ALTERNATING power systems employing machines of the synchronous type power is transmitted chiefly by difference in phase angle between the induced voltages in the machines at the two ends of the system. The magnitude of this phase angle is dependent upon the electrical constants of the transmission line, transformers and synchronous machines. Any reduction in this angle under steady load conditions improves the stability condition. Very little can be done in the transmission lines themselves, because their reactance is largely fixed by the spacing between conductors. In the same way the reactance of the transformers cannot be reduced below a fairly well-defined minimum. For this reason attention has been focused upon the design of the synchronous machinery.

From the standpoint of stability the principal characteristics of generating station equipment may be classified as follows:

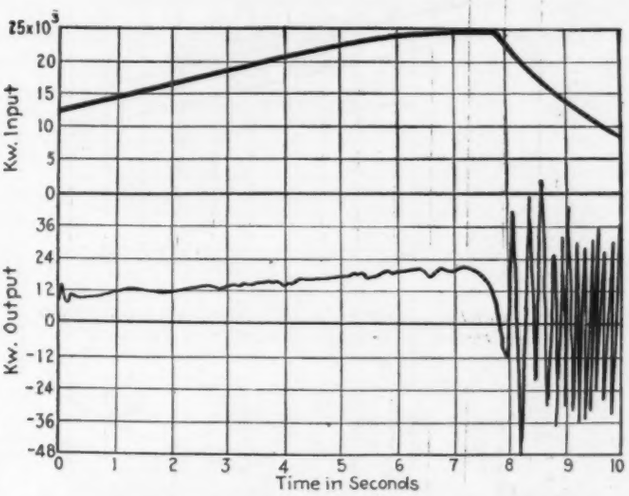
1. Prime mover input and governor control.
2. Inertia of rotating parts of generator and prime mover.
3. Reactance of the alternating-current machine.
4. Excitation system.

Modern prime movers with their constant torque characteristics and with properly adjusted governors



GOVERNOR RESPONSE TESTS WHERE 50,000-KW. LOAD WAS DROPPED FROM 60,000-KW. STEAM TURBINE

do not introduce any problems from the stability standpoint other than that incident to the amount of power to be transmitted. Periodic pulsations in prime mover input, such as caused by improper adjustment of governors, may produce hunting and even instability if the period of fluctuation corresponds with the natural period of the electromechanical oscillation of the power system. Prime mover control may become an asset from the standpoint of stability if it is capable of making an important reduction in prime mover input, following the initiation of a disturbance within the time required by the system to reach the critical angle. This, however, cannot be realized with most governors, because they are too sluggish, but it suggests the idea of supplementing the governor control by devices that would react to electrical conditions following a disturbance.



GOVERNOR ACTION DURING SINGLE-PHASE FLASHOVER

The second characteristic mentioned, inertia effect, plays a fundamentally important part in stability phenomena, because upon the inertia of the rotors and upon the reactance of the tie between the machines depends the periodicity of electromechanical oscillations. Increasing the inertia of machines is, however, not a practical method of improving the stability limit of a power system. It is beneficial in that it provides more time for corrective action to become effective, but it is relatively expensive and the same result can be obtained much more cheaply by speeding up the corrective action. It may be pointed out that the natural period of system oscillation is approximately the same for hydro-electric generating stations with long transmission lines and steam turbine generator units with closely connected systems.

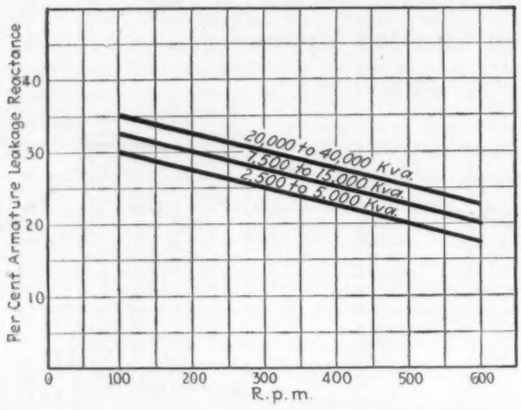
Definition of Terms Provided

As has been stated above, the reduction of the over-all system angle is important from the standpoint of stability. The reactances of a synchronous machine may be described by the use of three terms as follows:

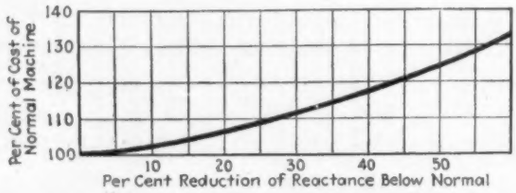
1. Armature leakage reactance.
2. Transient reactance.
3. Synchronous reactance.

*Abstract of article presented by C. A. Powell of Westinghouse Electric & Manufacturing Company to the apparatus committee, N.E.L.A., at Niagara Falls, N. Y., April 1, 1927.

The armature leakage reactance of a synchronous machine includes only the leakage flux of the armature circuit itself. Transient reactance is the value that determines the short-circuit current and is composed of the armature leakage reactance added to the field leakage due to the current induced in the field circuit by the change in armature current. Synchronous reactance gives the regulation of the machine at a given value of field current.



NORMAL LEAKAGE REACTANCE OF ALTERNATING-CURRENT GENERATORS OF VARIOUS SPEEDS AND RATINGS



INCREASE IN COST OF LARGE WATERWHEEL GENERATORS DUE TO REDUCTION OF NORMAL REACTANCE

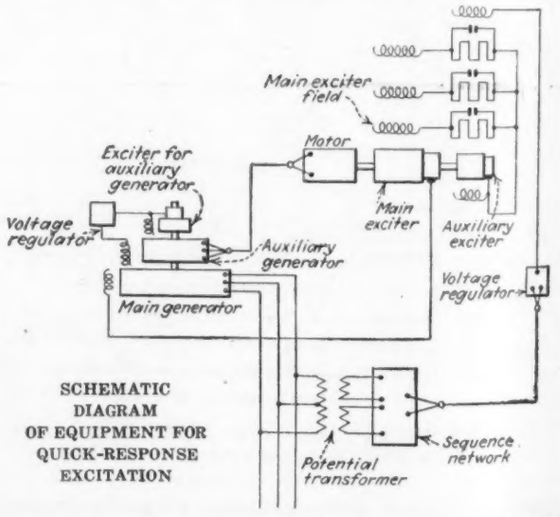
From the standpoint of stability for slowly changing load conditions with fixed value of excitation it is the synchronous reactance of the machine that determines the stability limit. With constant air gap voltage, however, the limit is determined by the leakage reactance, because the demagnetizing action is eliminated. For transient disturbances the leakage rather than the transient reactance value should be used, because the rate of change in armature current, even though it may have a high initial value, is comparatively slow, since it is determined by the electromechanical oscillations of the power system.

Since the advent of good voltage regulators it has been the practice to design machines for the lowest cost, and the reactance thus obtained for a given rating is commonly known as "normal reactance." This value of reactance is not necessarily the most desirable one from the standpoint of stability. However, it can be improved only at an additional cost in the machine. Thus the question of machine reactance is not purely a matter of design but involves economics. In the studies of systems made to date, in which stability had to be given consideration, the most desirable characteristics have run the cost of the machines 10 to 15 per cent above the cost of corresponding machines with "normal reactance." To a large extent the improvement in leakage reactance is obtained by derating a larger machine. Consequently the same general relation holds for improvements in transient reactance and in synchronous reactance. It should be realized, however, that a certain amount of independent variation is possible.

The question is sometimes raised as to what machine reactance is the most important from the standpoint of stability—that is, whether, in considering the characteristics of the machine, more importance should be laid on the leakage reactance or on the short-circuit ratio, which to some extent is the measure of synchronous reactance. The writer believes leakage reactance is the proper value to consider, especially if quick response excitation is contemplated, because in this case the air gap flux will be substantially maintained for single-phase flashovers on the high-voltage transmission lines.

A recent development in the art of regulation has been a regulator that would incorporate all of the advantages of the vibrating type regulator—namely, the speed of application of correcting force, together with the advantage of the rheostatic regulator. This regulator is of the rheostatic type—that is, a motor operated rheostat is used—but it is located in the exciter field circuit. The vibrating part of the regulator consists of contacts which short circuit the rheostat at the same time as the motor is put in motion, under the command of the control coil.

A single control magnet energized from a potential transformer operates on a lever system having two contacts, each one of which controls a contactor switch. The contactor switch in turn controls the motor-operated rheostat and also the vibrating field-forcing means. The anti-hunting is obtained in a similar manner to that of the vibrating regulator—namely, changing a section of resistance in series with the main control magnet. As soon as the regulator is in operation and a load has been applied to the generator, the voltage will be reduced and this will cause the lower contacts to close, thereby closing the auxiliary contactor switch. The closing of the auxiliary contactor switch starts the motor-operated rheostat and at the same instant short circuits this rheostat. Thus the same action is obtained as if a vibrating regulator is used.



SCHEMATIC DIAGRAM OF EQUIPMENT FOR QUICK-RESPONSE EXCITATION

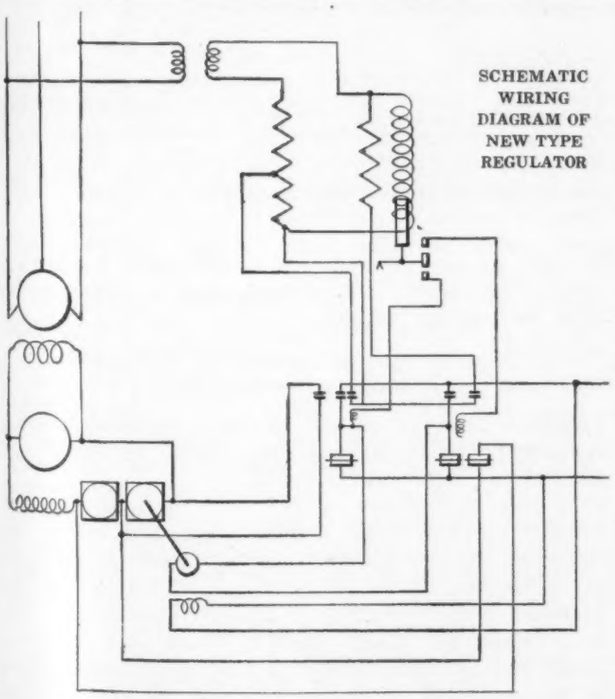
The speed of operation of the motor-operated rheostat is immaterial, as it will follow along and finally bring the rheostat to the correct position and the equipment will remain in equilibrium. The field reduction is taken care of by an auxiliary rheostat, which normally is short circuited by the lower con-

tact of the other auxiliary contactor switch. When the voltage increases, this resistance is inserted, causing a reduction in the exciter voltage in the same manner as the other contactor causes an increase in the exciter voltage. The vibration is produced by the auxiliary contactor carried on the switch. The regulator has very little damping on the control element, and this is obtained by means of an air dashpot.

In conclusion, it seems desirable to discuss briefly the question as to where special characteristics should be employed. From the standpoint of stability, power transmission systems may be divided into three classes, as follows:

1. One-way transmission.
2. Network transmission.
3. Closely connected networks.

One-way transmission refers to a system in which the generators are tied into the distribution network at the receiver end only, such as the 220-kv. system of the Southern California Edison Company and the Pacific Gas & Electric Company. A networked transmission system is one in which the bulk of the power is carried to the distribution points over transmission lines but in which the generating capacity is made up of a number of stations of moderate size connected with one another. Illustrations of this type of system are the 110-kv. systems of the Alabama Power Company and the Pacific Gas & Electric Company, as well as interconnections between different power systems. By closely connected networks is meant the type of system found in metropolitan districts in which the generating stations and distribution points

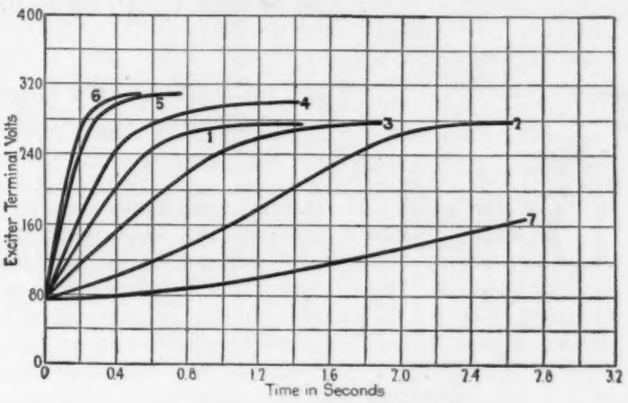


SCHEMATIC WIRING DIAGRAM OF NEW TYPE REGULATOR

are geographically close and in which the electrical ties are of very low impedance.

These systems are quite different in their characteristics from the point of view of stability. A one-way transmission system is inherently more susceptible to disturbances than the other types, owing to the fact that all of the generating capacity is directly affected by a given fault and because the proportions are usually such that a considerable phase angle is developed between the supply and receiver ends without intermediate voltage sustaining machines. For one-way transmission systems the design characteristics of the generators and their excitation systems are of considerable importance.

Whereas the output of the generating stations of a networked transmission system may be carried over



EXCITER RESPONSE CURVES

No.	Kw.	Circ.	Exc.	R.P.M.	No.	Kw.	Circ.	Exc.	R.P.M.	No.	Kw.	Circ.	Exc.	R.P.M.
1	145	3	Sep.	300	3	145	2	Sep.	300	6	240	4	Sep.	1,200
2	145	2	Self.	300	4	300	4	Sep.	970	7	95	1	Self.	180
					5	240	4	Sep.	1,200					

comparatively high-reactance lines, each individual station is usually tied in with two or more other stations, so that a fault causing the removal of one line does not appreciably lower the output capacity. In this type of system a comparatively small portion of the total generating capacity is affected by a given short circuit, which is conducive to a high degree of stability for the system as a whole. Furthermore, during a disturbance the multiple ties with other parts of the system cause the ensuing oscillation to be compound and rapidly damped. The regulation characteristics of generators are considerably less important than for one-way transmission.

Stability is seldom of importance in the operation of closely connected networks. The chief problems in this case are reliability of apparatus and adequate relaying.

It may be of interest, however, to review those situations where special characteristics of machines have been decided upon. During the past year decisions were made to employ special characteristics in the equipment at the new Big Creek 2-A power house, and for the motor end of the frequency changer set located at Farmersville at an intermediate point along the Big Creek 220-kv. transmission lines. In the Conowingo development of the Philadelphia Electric Company the stability problem is important, not because of the distance to which the power is transmitted—about 75 miles—but on account of the large amount of power to be transmitted, particularly under emergency conditions, which will be in the vicinity of 250,000 kw. over a single circuit. This has led to the decision to employ generators of specially low impedance at Conowingo and to equip these machines with the quick-response excitation system. For a different type of system, an interconnected network with moderate amounts of power per circuit, the Alabama Power Company decided to employ quick-response excitation systems for its Lock 18 and Tallahassee plants but not to use generators of abnormally low impedance.

Operating Problems in Interconnections*

Constant Pressure Source of Power from the Boiler Room Essential—High Standards of Operation Needed to Maintain Frequency and Proper Division of Loads —Experiences Cited to Illustrate Interconnection Problems

By Bert Houghton

Operating Superintendent Brooklyn Edison Company

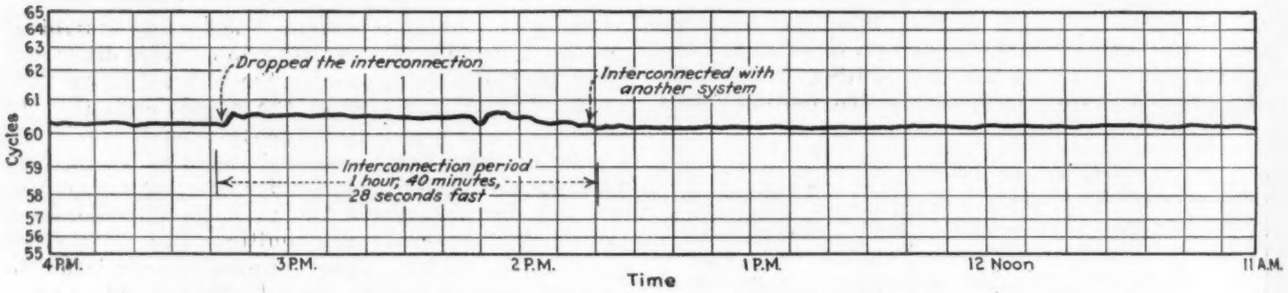
DISCUSSIONS of system interconnection have usually centered around the economics, the proper assignment and division of load on generating stations, "solid" and "loose" connections, the technical features of holding stations in step, the difficulties of overcoming circulating current, voltage regulation and power factor correction. The operating problems of generating stations in an interconnected system have been overlooked apparently. Perhaps the reason is that the stations were presumed to be able to hold the loads assigned to them and the system was assumed to maintain its frequency without effort. The inertia of the entire system, both mechanically and electrically, and the action of prime mover governors have been presumed to be sufficient to maintain equilibrium of load and speed.

From my own experience with interconnections and casual observations of systems I have visited I have noticed that there is a very marked seesawing of both power and frequency. In some cases it is so bad that the service cannot measure up to the standards that should be maintained and to which many companies have educated their customers.

The widespread use of synchronous clocks, in certain sections at least, requires that the average frequency check out at the end of every 24 hours. In many places the frequency maintenance is so poor that synchronous clocks cannot be connected to the service. Not only should the average frequency check out but the instantaneous frequency should be held very close to standard.

With the advent of the extremely sensitive frequency meters that can be obtained today, some surprising results are manifesting themselves. On one hand there are systems running with a frequency so uniform and with so little variation that at the time the sensitive meters were installed the manufacturer's men who installed them returned them to the factory to find out what was the matter with the meter, when in reality the meter was all right and the frequency was uniform. On the other hand there are records that show violent and large swings in frequency, first in one direction and then in the other, within very short periods of time, and some reports have reached me of synchronous clocks being out fifteen to twenty minutes in 24 hours.

Before going further I want to say that I am talking about the average usual operation and not about conditions that exist during local or system disturbances. The latter class of problem is the one to which the greatest amount of study has been devoted and the one which primarily is one of transmission system rather than generating station.



SYSTEM FREQUENCY WITH THREE STATIONS IN PARALLEL AND INTERCONNECTED WITH AN ADJACENT SYSTEM

In the one hour and 40 minutes while interconnected time clocks become 28 seconds fast because of frequency changes.

Multiplicity of Equipment Does Not Increase Steadiness

It may be supposed that the more equipment that is connected with the system the steadier the system will be, but that is not the case.

In order to lead you to my conclusion, I hope you will pardon my reviewing matters that are rather elementary. Let us picture a system running with constant frequency and constant load. This system may be assumed to be floating in absolute equilibrium. The only thing that should affect it would be a change in load. If this change in load is gradual and proportional to the connected generating capacity, the first thing we would obtain with a decrease in load would be a slight increase in speed, which we shall assume affects all the governors proportionally. To bring back the speed and still maintain the proportional division of load, *all* the prime mover governors must be reset. The reverse operation occurs when load is gradually increased.

The foregoing is very simple and presupposes ideal prime mover governors and controls. What occurs in practice is quite different. Station operators have their

*Paper presented before the Electrical Apparatus Committee of the N.E.L.A. at Niagara Falls, March 31, 1927.

orders to maintain definite loads and to divide the loads in a certain way on the generators that are in operation. Operators in other stations are required to maintain speed on the system, which requires that these stations pick up and drop load as the demand varies. With proper system discipline and careful attention to regulation, the operators can maintain a very high degree of service, both in frequency and load, up to this point.

STEAM PRESSURE SHOULD BE CONSTANT

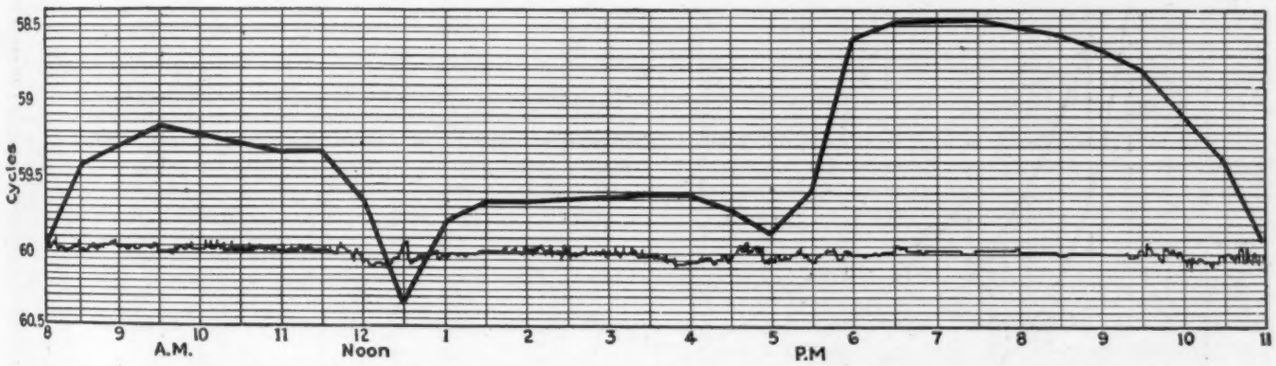
A very serious problem, however, enters into the operation of interconnected generating stations when we come to the matter of steam pressure. This is usually passed over with the suggestion that governor action is sufficient to compensate for changes in steam pressure, even though the pressure changes are comparatively large. This is only partly true, due to the great difference in the behavior of governors; even though designed and built the same, there is a shift of load and speed with every readjustment of any of the governors. To overcome this condition constant adjustment of governors must be carried out by the operators or there will be introduced into the system gradual swings in power and frequency that make it very difficult to control the flow of power over interconnected feeders and that practically eliminate any possibility of maintaining a decent frequency.

This picture tracks the responsibility for reasonably good system regulation with interconnected generating stations to the boiler room of the various interconnected stations. Although the subject of actual boiler room operation may be a little foreign to electrical engineers, even though they do provide the electric drives for the boiler room equipment, I want to bring this subject to their serious consideration in connection with the study of the problem of the generating stations in system interconnection. It is perhaps not carrying the matter too far to say that the men operating the electrical system should demand from the men who design and operate the prime movers and boiler room that they get a constant source of power for their alternators. I believe it is generally assumed, particularly due to the absence of any reference to it in electrical literature, that uniform and consistent service from the steam end of generator couplings is a normal condition. I do not by any means presume to place the entire responsibility for efficiency in maintaining a division in load with proper frequency entirely on the boiler room, as a great deal of it is up to the individual station operators and the system operator.

Load division without regard to uniform frequency is a fairly easy problem, but to maintain both at the same time requires the electrical operators to have a uniform and dependable source of energy under their control. Therefore it strikes me that the electrical engineer is very deeply concerned in making a survey of the interconnections that are now in operation to determine exactly the relation between the various boiler room steam charts and the frequency charts superimposed upon the interchange of load between stations.

Rumors have reached me that where steam and hydroelectric stations have been tied together, it is impossible to maintain frequency with a proper division of load. I am of the opinion that the technical problems involved are not nearly so great as is the method of operation. I feel that the electrical engineer is fully justified in asking for a uniform stable source of power from his colleagues on the other side of the generating coupling, and I believe that the problem of getting a uniform and steady frequency and a proper system distribution of load rests in the boiler room and prime movers and in a greater uniformity in prime mover governors, both steam and hydraulic.

As a purely technical exhibit without intending to compliment or disparage, I am appending several sets of frequency and steam charts where three stations are coupled together, all belonging to one company, and the frequency chart when the former system was tied to another system.



FREQUENCY RECORDED BY A VERY SENSITIVE METER ON A WELL-OPERATED SYSTEM AND CORRESPONDING SYSTEM LOAD

HANDLING THE WATTLESS KILOVOLT-AMPERAGE

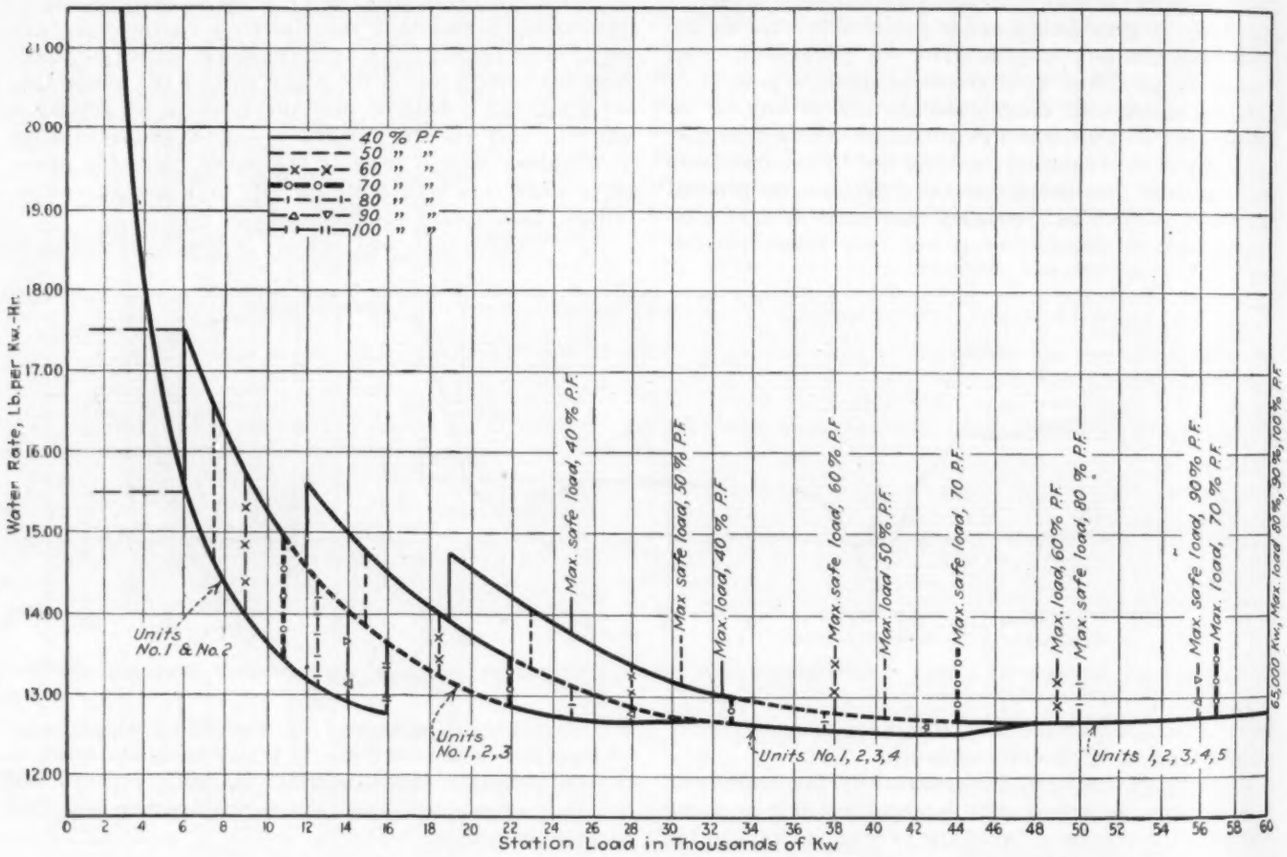
Another generating station problem which is largely electrical but which needs constant watching is that of taking care of the reactive current. Although there has been a great deal published on this subject from the system standpoint, very little has been written on it from the station standpoint, and in looking over reports on the economies that could be effected by the improved diversity of load and stand-by operation with interconnections there is no evidence of power factor entering into the problem other than in calling for reactive correction by synchronous condensers.

I have often had to run an extra generating unit purely to take up the reactive load in the case of another unit dropping out, which meant that a great deal more than the actual kilowatt capacity had to be available for emergency service. To you this will classify itself as a purely reactive problem, but to the operators it is considerably more. What it means is that generating

capacity in kilovolt-amperage must be kept on the line, ofttimes greatly in excess of the kilowatt capacity. This means uneconomical operation of turbines in that the turbines running are underloaded on the steam end and up to capacity on the electrical end. A set of curves showing the effect of reactive current for power factor on the water rate of a five-unit generating station having an installed capacity of 65,000 kw. is shown, and very graphically emphasizes that reactive current consumes coal.

Boiler Room Operation of High Standard Required

At the risk of reiteration, I want to leave with you the impression that if interconnected systems are to give that high quality of service to which many of the metropolitan districts are now accustomed, boiler room operation is going to play a very large part in the result, the discipline and supervision of station operators by the system operator must be maintained at a very high standard and station operators must be very carefully and thoroughly trained as to what they are able to do under normal operation in affecting the entire interconnected system and also their duties in restoring equilibrium of load and frequency immediately after severe system disturbances.


40 % P.F
50 " "
60 " "
70 " "
80 " "
90 " "
100 " "
Water Rate, Lb. per Kw.-Hr.
Station Load in Thousands of Kw
Units No. 1 & No. 2
Units No. 1, 2, 3
Units No. 1, 2, 3, 4
Units 1, 2, 3, 4, 5
Max. safe load, 40 % P.F.
Max. safe load, 50 % P.F.
Max. load, 40 % P.F.
Max. safe load, 60 % P.F.
Max. load 50 % P.F.
Max. safe load, 70 P.F.
Max. load, 60 % P.F.
Max. safe load, 80 % P.F.
Max. safe load, 90 % P.F.
Max. load, 70 % P.F.
65,000 Kw., Max. load 80 %, 90 %, 100 % P.F.

GENERATING CAPACITY ON LINE MUST BE GREATLY IN EXCESS OF KILOWATT REQUIREMENTS
This is necessary to care for wattless requirements in poorly operated interconnected systems. Effect on water rate is shown.

As I have made the boiler room the foundation from which to build up a continuously uniform electrical service on interconnected systems, you may perhaps be interested in getting a birdseye view of the major problems involved in maintaining a uniform steam pressure. The transition from the reciprocating drive to the turbine drive for alternators improved so materially the ability to run alternators in parallel that the effect of the boiler room on such operation has been almost entirely lost sight of, but now with large interconnections in view and the almost perfect service to which the general public has been accustomed, the steam end is again a vital factor.

One might almost say that automatic governors on the boilers are required to maintain steam pressure just as automatic governors are required to maintain uniform speed. The fundamental means of maintaining boiler pressure is of course adjusting the rate of combustion to correspond to the load requirements on the boiler. The most direct and sensitive method of changing the rate of combustion is in varying the air supply. In 1913 I developed an automatic regulator for the forced draft fans at the Gold Street station which consisted of a diaphragm that balanced steam pressure against the pilot control of a turbine governor, which operated the master cylinder connected to a line shaft, which in turn was linked to the governors of all the turbine drives for the blowers. In this way any change in steam pressure due to a change in the load demands on the boilers was immediately transmitted to the forced draft fans, speeding them up or slowing them down as required. This at once relieved the boiler room crew of the major part of the physical work in adjusting draft and gave them more time to devote to the condition of their fires and to the operation of the stokers. It at once resulted in a very much more uniform steam pressure, particularly under changing load conditions.

For a good many years no widespread attempt was

made to equip boiler installations with such automatic air control, but within the last five or six years a great number of combustion control systems have sprung up. Some of these are highly developed to compensate for the drooping characteristic that is inherent to the operation of any governor. Also, many more items are included in the automatic features, such as coal feed, damper control and draft control, which will sense poor fuel bed conditions.

The other item materially affecting uniform boiler operation is the matter of supplying the boilers with feed water. Stability of boiler operation requires a constant level in the boiler drum and a uniform head between the boiler drum and the feed water, across the regulating equipment at the boiler drum. This carries us back to the boiler feed pumps, which should operate against constant head from a constant suction pressure. In other words, the picture I have tried to give you means that as many items as possible should be stabilized, as the entire operating result depends on a great many variables, each one of which, whether it is recognized or not, has an appreciable effect on the whole chain of circumstances connected with system operation. The greater the number of variables that can be stabilized and held reasonably constant the easier it is to provide uniformly good service.

EFFECT OF SHIFT IN LOADS

There are certain periods of the day, such as the morning increase in load, the noontime valley and the evening peaks, which in reality occupy a considerable proportion of the 24 hours and during which times the greatest skill is required in changing and shifting loads and maintaining frequency. During these periods the system load can materially affect boiler room operation on various plants that are interconnected by the method of increasing and dropping loads and assignment of the station that is to control frequency.

Three fundamental schemes may be followed out. The first is to assign a constant load to a number of stations and assign speed control to a single station. This means that all variation in load must be taken on the one station, which in turn means that the boiler room of the station holding speed is subject to very rapid fluctuations in load. The second scheme is a modification of the first, in which the speed control is shifted from station to station for five, ten or fifteen minutes. This means that the station holding speed is subject to rapid changes in load and in boiler room operation during the interval in which the station is carrying speed. The third scheme is to permit all the stations to share in the increase or decrease in load according to a schedule predetermined for the normal system changes in load. This means that for all but one station a definite time load curve is assigned to each interconnected station. The result of this is that all boiler rooms share proportionately the normal fluctuations in load and the station that is called on to regulate speed does not have to take care of the entire change of load during the period of rapid system change. Not only is system frequency greatly improved but boiler room operation and efficiency are materially improved when the third scheme is used.

My remarks have been made to focus your attention on one of the vital problems with which we must contend in operating any systems which are extensively interconnected.

Letters from Our Readers

"Television" Held to Be a Wrongly Chosen Word

To the Editor of the ELECTRICAL WORLD:

In your first editorial in the issue of April 16 the word "television" is the one most prominent. This word is continually used in the public press and technical magazines as denoting the mechanism for the mechanical extension of human sight. Do we not see with the eyes, and is not this process one of sight, not vision? Vision is a metaphysical thing, a prophetic insight or inspirational action. Vision is an aspect of the result of the action of unknown stimuli on the human nervous system. Why, then, do we not speak of this wonderful new development of the extension of human sight as "telepicture" (still picture), "telemotion picture," "teleview" and "telesight"? Vision is not dead, but merely temporarily lost, to reappear again in greater beauty and strength. Without vision a people perish!

C. L. KASSON.

Roxbury, Mass.

Contends that Shade Makers Should Provide Attachments

To the Editor of the ELECTRICAL WORLD:

We have no objection to shading the light source when the design of the fixture is such that shades can be used to advantage. But we do not believe that *all* fixtures should be shaded, nor do we believe that the fixture manufacturer should be criticised for failing to provide shade holders on the lighting equipment he produces. The shade is an accessory to the fixture, and in all other industries the accessory manufacturer equips his product with means for attaching it to the thing with which it is designed to be used.

There are on the market a number of attachments for the telephone—some of them very useful attachments—but the design of the telephone is not altered to enable you to use these accessories. The manufacturer of the accessory provides his own means of attaching it to the instrument. Manufacturers of silk and parchment shades provide their own shade holders, and we know of no reason why glass-shade manufacturers should not do the same instead of expecting the fixture manufacturer to add to the cost of his own product for the purpose of making it easier to use their product.

CHARLES L. BENJAMIN.

Beardslee Chandelier Manufacturing Company, Chicago.

Remote-Control High-Tension Station

To the Editor of the ELECTRICAL WORLD:

As author of the article "Remote-Control High-Tension Station," which appeared on page 854 of your April 23 issue, I note two minor errors in Fig. 2, on page 855. The negative lead should connect to the middle point of the control switch at West Salem. In the chart giving number of control wires required between Salem and West Salem the wires which are marked "commercial" should have been designated "common."

JOHN BANKUS.

Portland Electric Power Company, Portland, Ore.

Central Station and Industrial Practice

Checking Meter Grounds

By Nicholas Cook
Electric Meterman Public Service Electric & Gas Company, Paterson, N. J.

THE ordinary meter-testing load panel is designed to test the accuracy of watt-hour meters, but gives no indication of "crosses" between coils or terminals and the meter base. If a grounded meter is set on the line, the usual consequence is blown fuses and considerable loss of time. When such a meter does not come into contact with a grounded cabinet, the meter remains "alive"—a highly undesirable condition which could not be permitted to remain.

To guard against such dangers and to facilitate complete testing on load panels, the writer has devised a ground detector that will indicate grounds on any terminal of an alternating-current watt-hour meter by means of an instantly perceptible signal. A diagram of the circuit is shown.

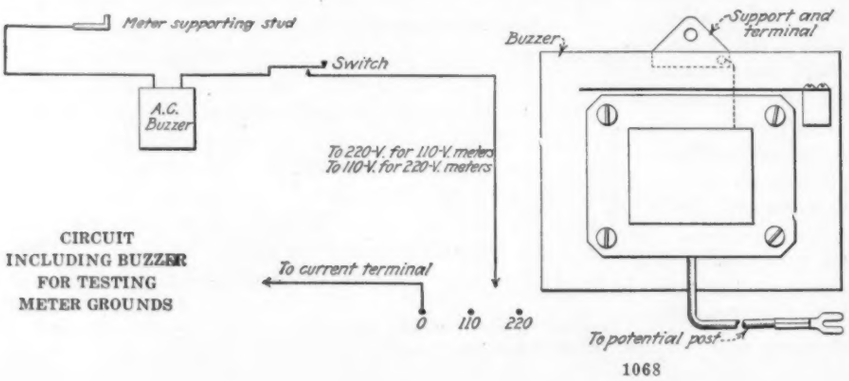
The buzzer is made of a potential element from an I-14 or D-6 meter. The armature, a piece of clock spring. is set in a block, which may be turned to secure proper adjustment. This block must then be locked firmly in position so that the adjustment will not be disturbed. Of course, any suitable alternating-current buzzer may be used instead of this home-made apparatus.

The device should be mounted on the back of the panel, the brass plate being clamped under the nut that holds the meter-supporting stud. The flexible wire may be brought to the front in any convenient way. It must be observed that this wire is connected to the 220-volt post for 110-volt meters and to the 110-volt post for 220-volt meters. The push-button should be set in the face of the panel in an easily accessible position.

When testing a meter on a board equipped with this device, the meterman depresses the ground detector button momentarily before proceeding with the accurary test. This puts a difference of potential between the meter base and any terminal. Therefore the buzzer will operate if any terminal is crossed with the base.

The omission of the push-button switch would simplify the circuit and would make its operation independent of forgetfulness on the part of the tester. On the other hand, it would leave the meter base connected to a potential of 110 or 220 volts, introducing an entirely unnecessary hazard.

The device described has been found highly successful, and the writer feels sure that other meter departments may profit by its adoption.



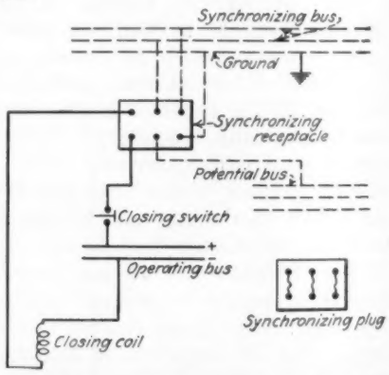
CIRCUIT INCLUDING BUZZER FOR TESTING METER GROUNDS

Operating Routines in Small Plants Are Important

By E. J. Morrissey
Chief Electrician Western United Gas & Electric Company, Aurora, Ill.

OPERATING routines are usually very definitely established in the larger power plants of the country, but they are not generally crystallized into familiar rules in the smaller plants. With the increasing accession of heretofore independent plants into interconnected systems through holding company ownership and centralized management the importance of a set routine of operation in even the smallest plants is rapidly growing. Such rules are merely the expressions of common sense in operating practice, but the results of a survey of small plants would probably surprise some of us with evidence that common sense is not as common as the term implies.

It is not unusual to find companies in which any person who cares to exercise it has the authority to order lines and equipment in and out of service. These are small organizations where every one knows every one else by name. Nevertheless, although the plant operator, Bill, has known the lineman, Joe, from childhood, there is ever present the possibility that Joe may tell Bill to close a line while Charley, the man who ordered it open, is still working barehanded with his connectors on top of a pole. For this reason there should be a definite check on operating orders, supplied either by their transmittal through one man or by some system of switch tagging.



SCHEMATIC DIAGRAM OF OIL-BREAKER CONTROL SHOWING SERIES CONNECTION OF CONTROL SWITCH AND SYNCHRONIZING PLUG RECEPTACLE

Telephone communications included in operating functions should be perfectly standardized. The first and most important item is the repetition of orders by the order taker to the order giver. A second is the necessity for operating orders to pass through few persons; if pos-

sible, the man who executes the order should be the one to receive it. Another thing should be the absolute exclusion of outside calls during times of trouble. Giving information over the plant phone to customers who want to know what is the matter with the lights is not a proper job for a plant operator or any one else during an emergency.

The compilation of a set of plant rules, as earlier stated, is merely a matter of using common sense. Listing operations and then giving a little thought to the methods and reasons for the methods of performing these operations will result in a very workable schedule. As an instance of the process of rule formulation, consider the invariable practice of one operation in the plant where the writer is employed: When a generator is taken off the line, the disconnecting switches on both sides of the oil breaker are opened. When the generator is to be put back, the oil breaker is closed and opened dead to be sure that it is functioning properly; then the disconnects are closed and the machine is put on. The operator, by performing these actions, has checked the oil breaker and has inspected the devices in the switch and bus room prior to a major operation.

In addition to the foregoing, the rule instructs the operator to inspect the control switch on the board before a major operation. The reason for this is tied in with the further instruction to insert the synchronizing plug when the incoming machine is up to line voltage and frequency and not before. As is shown in the drawing, the synchronizing plug receptacle jacks and the control switch of the oil breaker are in series with each other. In the writer's experience there have been two occasions when the pull switch was jammed in the closed position by a loose cotter key in the switch rod. In one case this condition was caught by inspection and in the second the oil breaker operated when the synchronizing plug was inserted. By observance of the rule the operator had the incoming machine up to frequency and voltage and no harm, beyond dusting off the generator coils, was done. If the operator had plugged in while the machine was just starting to roll, there would probably have been an unexpected and imposing display of fireworks.

The examples here cited demonstrate the manner of formulation of rules and prove their necessity. There is no electricity-generating plant, however small, that has not inherent in it a potentiality of danger to life and property and no plant is any safer than the men who operate it are willing to make it. A means to safety is the whole-hearted acceptance of a definite operating routine that must never be departed from.

Rural-Line Specifications—II

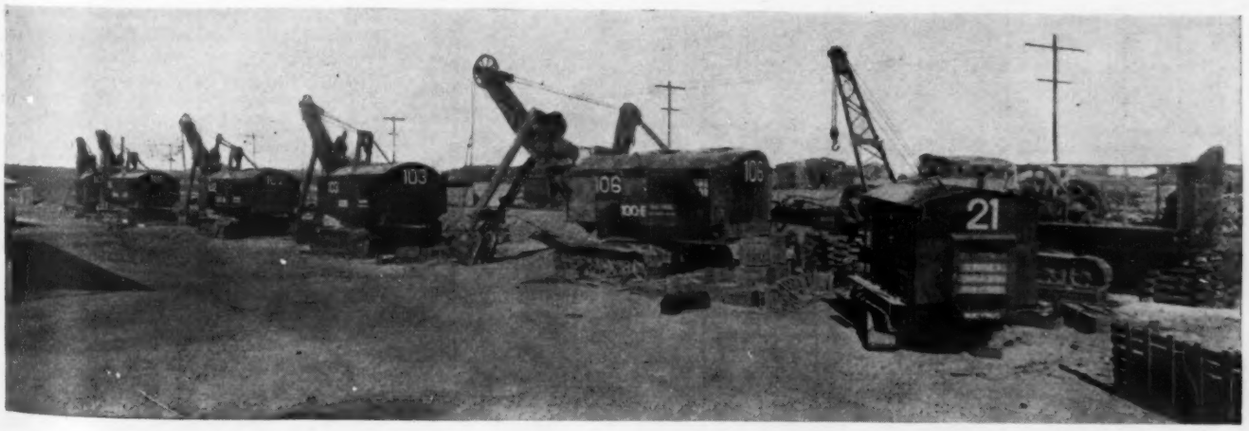
Of Wisconsin Power & Light Company

Locating Lines

IN GENERAL, rural electric light lines should be located along roadways. The principal lines or main feeders should be placed along main highways whenever possible. The main highways are more likely to be kept open during winter months and not to be muddy during fall and spring months, thereby permitting fast travel.

In order to reduce the number of crossings to a minimum, rural lines should be located, as far as possible, along one side of the highway. Care shall be taken to obtain, whenever possible, unobstructed right-of-way and to select the side of the highway most free from trees. It is preferable that electric lines be not located on the same side of the highway as telephone lines unless poles are jointly used. Telephone lines that

Nitrate to Be Mined with Electric Shovels in Chile



FOR the first time in the history of nitrate production on the Chilean desert power-operated shovels are to be used on a commercial scale for stripping the overburden and for mining the nitrate-bearing rock. This will be done by the Anglo-Chilean Consolidated Nitrate Corporation, which is at present building a plant at Coya Norte. This plant is to be located at the mines on the Chilean pampa about 5,000 ft. above sea level and 40 miles inland.

As the ore is mined it will be handled by six Model 100-B Bucyrus full-revolving shovels. Each shovel will have a dipper capacity of 3 cu.yd. and will be driven by a motor-generator unit consisting of a 190-hp. motor and three generators having a total output of 150 kw. connected to the three main motors on each shovel. From these shovels the ore will be loaded into trains which are pulled by electric locomotives and hauled from the workings to the mill where it is to be treated.

Practically all of the electrical equipment for the project is being furnished by the International General Electric Company, including the locomotives, substations, electrical equipment on the shovels and the majority of the industrial motors.

Power will be generated by Diesel engine-driven units. The generators and all the switchboard equipment were obtained from European manufacturers.

TABLE I—OVERHEAD CLEARANCE

The numbers represent the clearances in feet to be provided by the conductors or wires of classes specified at the heads of columns above places specified at the side of the table.

For spans exceeding 150 ft. clearances shall be increased by 1 in. for each 10 ft. of the excess between 150 and 300 ft. and by 1 in. for each 20 ft. of the excess beyond 300 ft.

	Guys, Spans, Lightning Protection Wire and Supply Lines and Services Less Than 300 Volts to Ground, Ft.	All Conductors Operating at Voltage from 300 Volts to Ground up to 15,000 Volts Between Conductors, Ft.
Crossing above track rails of steam railroads	27*	28*
Along streets or alleys in urban districts	18†	20
Crossing streets or roads in urban or rural districts	18	20
Along the roads in rural districts or other places where vehicles are likely to pass	14†	18
Crossing above spaces or ways accessible to pedestrians only	10‡	15

*This clearance may be reduced to 25 ft. when paralleled by trolley contact conductor on same street or highway.

†This does not apply to guys that are not carried over, but merely beside streets or alleys unless also over driveways. Over roadways to residence garages 10 ft. is sufficient clearance.

‡For guys 8 ft. will be sufficient, and no clearance is required for anchor guys not passing across pathways, or for those parallel with sidewalk curbs where traffic guards are provided.

are located on the same side that the electric line is to be built should be moved to the opposite side of the highway. If joint construction is not feasible and the electric line must be placed on the same side with signal lines on separate poles, the poles should be so placed that the telephone wires will not come in contact with them, and of sufficient height to give a conductor clearance in accordance with Table I. The electric line must be constructed to conform to the grade specified in Table III. The principal changes necessary to standard lines are indicated in Table II.

Inspection of Substation Equipment

AVERY wide diversity in practice and a total lack of agreement as to the proper inspection schedules in substation inspection and maintenance work were brought out in the electrical apparatus committee's report presented at the recent Memphis convention of the Southeastern Geographic Division of the N.E.L.A. This section of the report was obtained by questionnaires sent out to the various operating companies in the division, replies being received from eight companies. Results of the questionnaires as summarized by the committee follow:

Oil Circuit Breakers.—Inspections of breakers from 22 kv. to 110 kv. varied in frequency from six weeks to one year, and routine oil tests from one month to one year. In one instance inspection was on the basis of number of operations, breakers being inspected after twelve operations, and in practically all cases extra inspections were made when breakers showed any distress. In the case of breakers from 6.6 kv. to 13 kv., inspections varied from three weeks to one year, or on signs of distress, and oil tests varied from one month to one year. In the case of 2.3-kv. breakers, inspections varied from six months to one year, or on signs of distress, except that in one instance a large company reported that these breakers were never inspected unless they showed distress. Replies indicate that most companies have some sort of an inspection report form and follow-up, though numbers of companies have neither. Many of the companies' reports indicate that they do not have a very clear conception of what to look for on inspection. These inspections, in general, cover condition of bushings, contacts, oil and operating mechanism. In most instances the same crew does the inspection and makes repairs, but in at least one outstanding case the inspection and repair personnel are different. Equipment supplied for this work consists of a truck, oil filter, oil-testing equipment and various small tools.

Transformers.— Inspection schedule for transformers of various classes varies from one month to one year, and oil test periods show a similar variation. There is no agreement among the various companies as to proper inspection periods, even for transformers in the same classes. Most companies have various record systems and some follow-up scheme. Inspections are in some instances made by substation operators, but in most cases by a special inspection personnel. Inspection, in general, covers bushings, meggering of windings, physical condition, tap settings, oil levels, leaks, temperature, terminal board, sludging and oil test, though here again some of the companies apparently do not have any clean-cut idea of what they are inspecting for. Major equipment supplied for inspection and maintenance consists of a truck, filter, oil-testing equipment, megger and various instruments.

Automatic Equipment.— Apparently there is not a great deal of this in use,

TABLE II—CHANGES REQUIRED TO STANDARD CONSTRUCTION WHERE HIGHER GRADE IS REQUIRED

The end structures of all parallels and of all crossings are to be head guyed and double armed. Railroad crossings where width of right-of-way permits, should not exceed 100 ft. The table does not take into account vertical clearance. If the class pole listed is not standard in the length required for proper clearance, a pole of proper class and length must be used.

Type of Line	Min. Class Pole	Grade A Construction — Crossings — Max. Span, Ft.	Grade A Construction — Crossings — Side Guys	Grade A Construction — Parallels — Max. Span, Ft.	Grade A Construction — Parallels — Side Guys	Grade B Construction — Crossings — Max. Span, Ft.	Grade B Construction — Crossings — Side Guys	Grade B Construction — Parallels — Max. Span, Ft.	Grade B Construction — Parallels — Side Guys
1	B	...	...	177	No	240	No	240	No
	C	150	Yes	123	No	150	No	195	No
2	B	...	...	235	No	...	...	...	...
	C	150	Yes	163	No	240	No	240	No
	C	150	Yes	240	No	...	...	...	...
3	D	...	...	...	...	240	No	240	No
4	B	...	...	236	No	...	...	...	...
	C	150	Yes	164	No	240	No	240	No
	D	...	...	...	...	180	No	210	No
5	B	...	...	170	No	230	No	230	No
	C	150	Yes	118	No	144	No	187	No
6	B	...	...	183	No	210	No	210	No
	C	150	Yes	127	No	194	No	202	No
7	B	...	...	210	No	...	...	...	...
	C	150	Yes	169	No	210	No	210	No
	C	150	Yes	210	No	...	...	...	...
8	D	...	...	...	...	210	No	210	No
9	B	...	...	210	No	...	...	...	...
	C	150	Yes	168	No	...	...	...	...
	D	...	...	...	...	210	No	210	No

TABLE III—GRADES OF CONSTRUCTION REQUIRED FOR DIFFERENT CONDITIONS*

Crossing Over / Crossed Over	Signal Lines		Supply Lines — 750 Volts and Less		750 to 5,000 Volts		5,000 to 7,500 Volts		Above 7,500 Volts	
	Imp't	Unimp't.	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Alone, or guys service loops, highways	None	None	None	None	C	None	C	None	B	None
Unimportant signal lines	None	None	None	None	C	C	C	C	B	B
Important signal lines	None	None	None	None	C	C	B	B	A	A
Important railways†	D	D	A	A	A	A	A	A	A	A
Minor tracks‡	E	E	B	B	B	B	B	B	B	B
Trolley 750 volts and less	C wire size and sag		None	None	C	None	C	None	B	C
Supply lines 750 volts and less	None	None	None	None	C	None	C	None	B	C
Supply lines 750 to 5,000 volts	C	C	C	None	C	None	C	None	B	None
Supply lines 5,000 to 7,500 volts	B	C	C	None	C	None	C	None	B	None
Supply lines above 7,500 volts	A	B	B	C	B	None	B	None	B	None

Electric construction is of the open type.

*This table applies to crossings, conflicts and joint use of poles. The letters in this table refer to grades of construction as described in the National Electrical Safety Code.

†Unimportant signal lines are lines carrying not more than four wires used mainly for local service or subscribers' loops, or not more than two local telegraph or fire alarm wires.

‡Minor tracks are spurs less than 2,000 ft. long and not exceeding two tracks in the same span, branches on which no regular schedule is maintained, narrow-gage tracks, non-public utility tracks, or temporary tracks used for a period not exceeding one year.

except in the case of perhaps two companies. Inspection schedules vary from twice a week to three months, depending on the class of equipment, service and importance. Inspection personnel varies from the ordinary maintenance crew in some cases to a personal inspection by the chief operating engineer in others, but most of the companies have a man, or men, who specialize on this work. Most of the inspections include actual operation, and it is suggested that it is important to provide bypass facilities where necessary to permit of this. Some of the companies have methods of inspections and tests, although this feature has not yet been standardized, except in a few cases. Inspections, in general, cover adjustment, correctness of operating cycle, auxiliary switches, reading counters, lubrication, contacts, etc., and in some instances the extent of the inspection depends upon the number of operations that have taken place.

Relays.—Inspection schedule for relays shows an extremely wide variation. There seems to be little distinction made as to the necessity for different inspection schedules for various classes of relays, and general inspection periods for all classes vary from one month to twelve months. The inspection personnel for relay equipment is, in general, more specialized than for other equipment, as might be expected. Practically all companies have some form of a record and follow-up system, and in some cases this is quite elaborate. Most of the companies have their inspection personnel make minor repairs. About 50 per cent of the companies use phantom loads. The inspection equipment, in general, includes some sort of a loading device, cycle counter, ammeter, voltmeter, sign-lighting transformer, and in some instances phase angle meter, phase shifter, stop watch, etc.

Routine Oil Conditioning.—Replies to the questionnaire on this subject were received from twelve companies. These replies brought out the fact that practically all of the companies replying do not have a regular schedule for reconditioning oil, but follow the practice of filtering only when tests indicated bad oil. All but one recondition oil when tests indicate it to be necessary, and this one replaces with new oil every two years. Practically all follow a regular schedule of tests, which varies from monthly to yearly periods. For reconditioning the majority use filter presses, and only a few have made use of the centrifugal purifier. The majority consider the centrifugal purifier has a special use, and only one company uses it universally. Most of the companies use both portable and stationary filter processes.

Interruption Reports

A SURVEY of ten companies in the Southeast made by the sub-committee on operating methods and routine of the electrical apparatus committee of the Southeastern N.E.L.A. and presented in the annual report at the Memphis convention on April 13 showed that all of these companies kept a record of interruptions to customers and outages on transmission lines and equipment. Some of these companies had more detailed reports than others. Six make use of a daily form, whereas the four others make a monthly summary. A few also make a yearly report of interruptions to customers.

Samples of the various forms in use were submitted by the companies, and from these samples the forms shown in the accompanying illustrations have been suggested by the committee as possible standards for use throughout the division. The first form is the daily system trouble report, the second the monthly system trouble report and the third a continuous record of all interruptions on each transmission line or feeder, with the effects of each interruption on each customer.

SUGGESTED FORMS FOR DAILY, MONTHLY AND YEARLY SYSTEM TROUBLE AND INTERRUPTION REPORTS

Commercial Activities and Public Relations

Water Heater Experience in the Southeast

THE report of the water heating committee of the Southeastern Geographic Division of the N.E.L.A. presented at the recent Memphis convention contained data that should be of value to commercial men.

The committee concluded that before much could be done to promote the sale of electric water heaters it would be necessary to have information on the following subjects:

1. What the customer now using gas, oil, coal or some other fuel for heating water is willing to pay for complete hot water service.

2. The amount of energy consumption for present installations under different conditions.

3. The increase in revenue to the central station after the installation of the electric heater.

4. What is necessary to get consumer and central-station salesmen acceptance of electric heating devices.

In connection with the first item, a survey was made in which reports from about a hundred households were obtained. The questionnaire covered the size of house in rooms, including laundry and bath, number of hot-water outlets, tub or shower type bath, number of adults and children under fourteen in family, whether laundry was done at home, self-closing or regular faucets used, in what part of house water heater was located, type, size and make of heater, type of fuel used to heat water (coal, gas, oil or electricity), size of tank in gallons, type of service (continuous or intermittent) and amount person was willing to pay per month for complete convenient hot-water service.

The analysis of these questionnaires made by the committee showed that the amount that a family was willing to pay for hot-water service varied a great deal. Those with small families were often willing to pay more than those with large families, and the man with a large house frequently indicated an unwillingness to pay as much as the man with a small house.

The reports from non-users of electric heaters in Florida covering eight towns served by one company indicated that the average tank size was 30 gal., that the average number of hot-water faucets in use per residence was four and the average amount the customer was willing to pay for complete hot-water service was $4.75 per month, or $1.19 per hot-water outlet.

In Tennessee the report was al-

TABLE I—AVERAGE MONTHLY BILLS OF CUSTOMERS BEFORE AND AFTER ELECTRIC HEATERS ARE INSTALLED

Combined lighting and cooking: First 40 kw.-hr. at 9 cents, balance at 3 cents with 5 per cent discount.

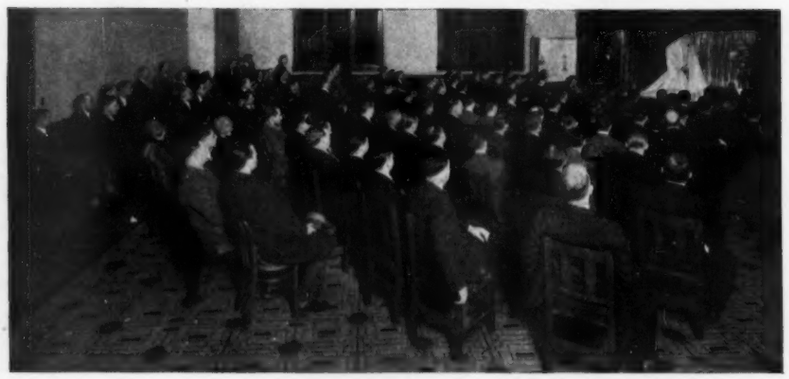
	Range and Lights	With Heater	Increase
1	$9.10	$13.06	$3.96
2	10.04	15.08	5.04
3	7.12	10.06	2.94
4	3.00	7.50	4.50
5	6.80	9.72	2.92
6	10.36	14.80	4.44
7	13.43	17.79	4.36
8	8.10	12.07	3.97
9	11.00	14.07	3.07
10	11.65	16.04	4.39
11	9.00	13.75	4.75
12	17.05	20.30	3.25
13	8.30	11.80	3.50
14	14.00	18.00	4.00
15	8.08	12.61	4.53
16	6.80	9.43	2.63
17	7.39	12.02	4.63
18	6.39	8.67	2.28
19	7.40	10.00	3.60
20	5.80	9.08	3.28
Average	$9.04	$12.79	$3.80

TABLE II—RESULTS OF 30-DAY TESTS CONDUCTED ON WATER HEATERS

Size of Tank, Gal.	Size of Heater, Kw.-Hr.	Make and Type	Consumption, Kw.-Hr.
	Non-Insulated, Non-Automatic		
30	3,500	Westghse Circulation	240
30	5,000	Westghse Circulation	226
30	2,500	Westghse Circulation	196
30	2,500	Hotpoint Circulation	160
30	2,500	Hotpoint Circulation	228
30	2,500	Hotpoint Circulation	92
	Non-Insulated, Automatic		
30	3,500	Westghse Circulation	1,050
30	5,000	Westghse Circulation	740
30	2,500	Hotpoint Circulation	460
30	2,500	Hotpoint Circulation	347
	Insulated, Non-Automatic		
30	3,500	Westghse Circulation	218
30	2,500	Hotpoint Circulation	209
	Insulated, Automatic		
30	3,500	Westghse Circulation	750
30	2,500	Hotpoint Circulation	560
30	4,500	Sepco	328
30	4,500	Sepco	273
20	3,000	Sepco	274
15	3,000	Sepco	145
5	1,000	Red Crown	240
10	....	Clark	110
10	....	Clark	96
5	....	Clark	105

The Sepco, Red Crown and Clark water heaters are tank and unit combined. The Sepco and Clark have the unit installed in bottom of tank, and the Clark is a strap-on heater. A few miscellaneous heaters of the Westinghouse and Hotpoint circulation type show an average consumption for more than a year of about 200 kw.-hr. per month.

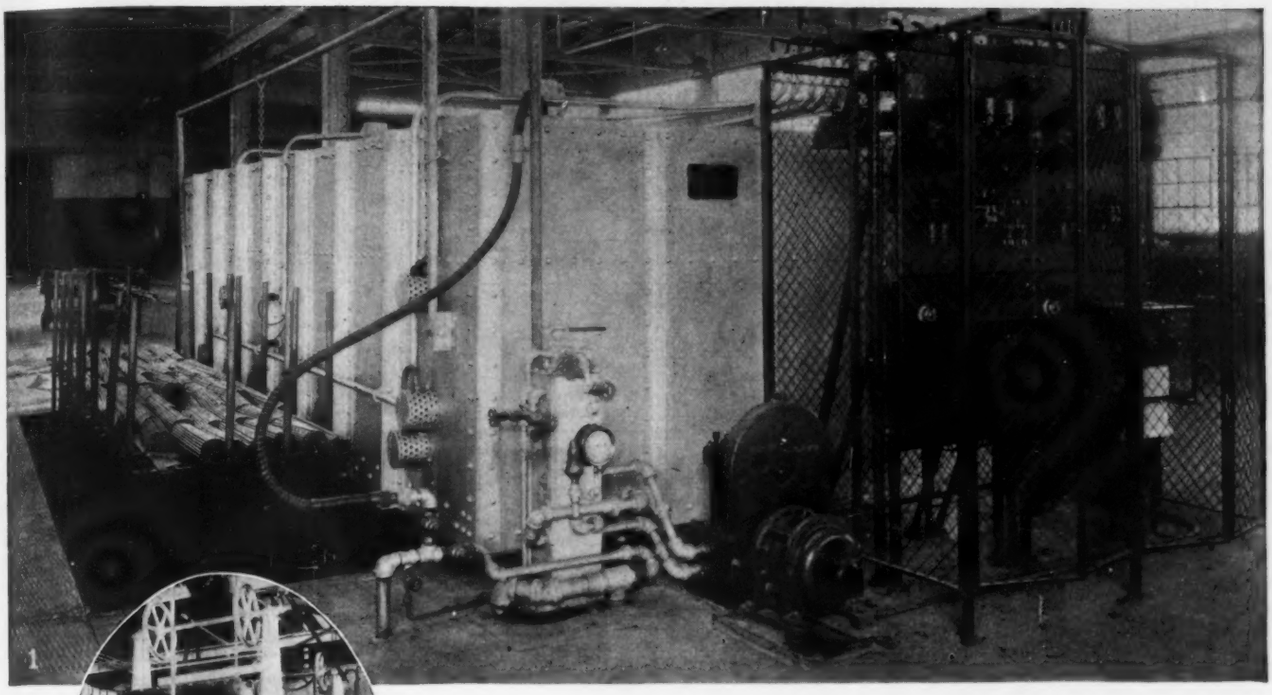
Lighting Lecture Course Creates Interest

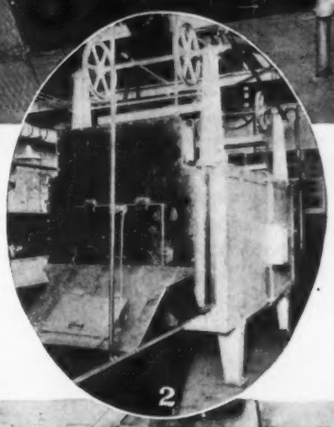


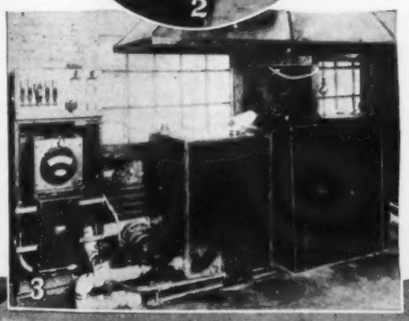
CONSIDERABLE interest in the lighting field has been shown in Pittsburgh through a series of six lectures completed recently at the Carnegie Institute of Technology. The course was sponsored jointly by the Illuminating Section of the Engineers' Society, the Carnegie Institute and the Electric League, and resulted in a total registration of 827 for the combined lectures.

The course was planned to give, primarily, the groundwork for lighting practices, with later lectures on specific subjects of interest, including such items as: Units and lighting concepts, lighting sources, reflecting and diffusing media, industrial lighting, commercial lighting, display windows, showcases and floodlighting.

Each lecture was illustrated by laboratory or commercial equipment as needed to cover the subject. A 10x6-ft. window trimmed by a local department store and arranged to show many combinations of light and color was available, as shown in the accompanying illustration. Another innovation was the street lighting and traffic signal lecture, which was attended by a large number from municipalities in the Pittsburgh district.







Industrial Electric Heating Advances

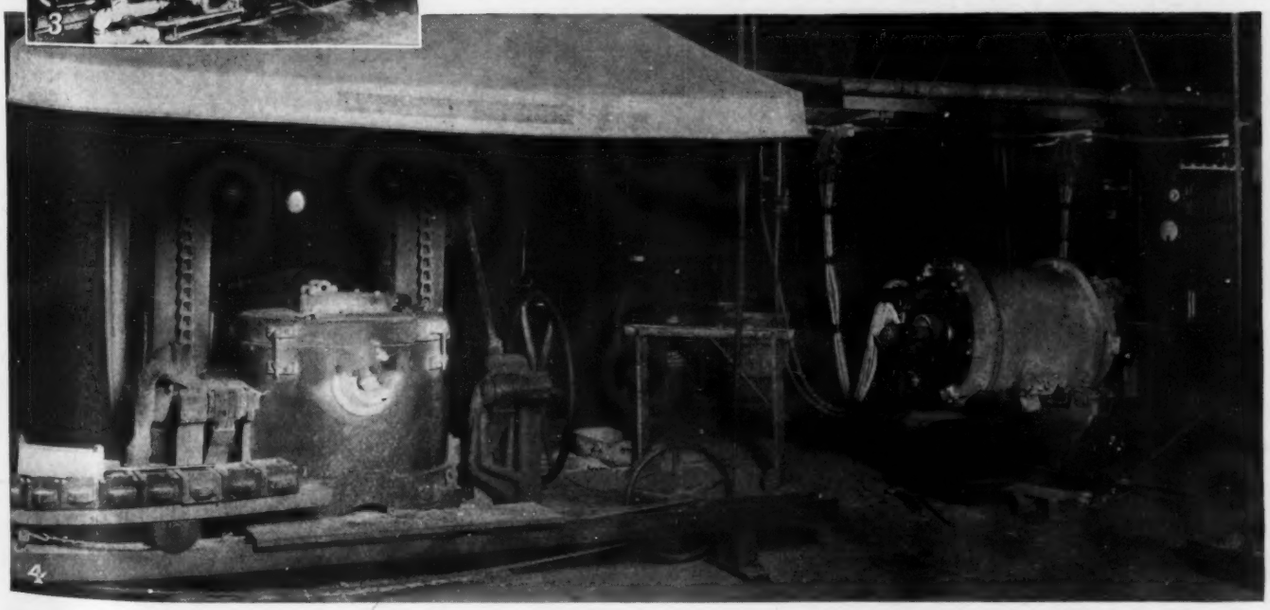
INDUSTRIAL heating engineers are turning to electricity as never before in solving the problems of manufacturers. Mass production on a quality basis is the keynote of successful electrical service in these fields. In recent applications a marked trend toward rugged design is evident in the electrical equipment. Special attention is being paid to the increase of accuracy of process control, to the reduction of losses in material and energy used and to improved accessibility and working conditions. Less and less do installations give the visitor impressions of experimentalism; more and more are high-grade engineering and construction in evidence.

No. 1. 390-kw. water-sealed furnace for non-oxidizing electric annealing of copper tubing. Improved heat distribution and the use of demand control are reaping important savings in this field.

No. 2. 60-kw. furnace for electrically annealing nickel-silver tableware blanks; a new application with promise of striking economies in labor, fuel and material handling against older methods.

No. 3. 33-kw. (maximum) electrically heated oil tempering bath. In the manufacture of hacksaws this outfit insures accurate control of the tempering process accompanied by rapid heating of oil when required, with reduction of fire risk and improved working conditions as a consequence.

No. 4. 160 kw. in brass melting furnaces in a hardware plant served by the Connecticut Light & Power Company. In this field users are enthusiastic over the economic success of electricity.



most the same, with the exception that the average size of tank in use was nearly 40 gal. The average number of hot-water outlets was 3.3 per residence and the customer was willing to pay $3.38 per residence, or about $1.03 per outlet. · One company in Tennessee submitted the figures given in Table I, giving the average monthly bills before and after installation of electric water heaters. It will be observed that the average actual increase in the amount of the monthly bill after the installation of the heater is $3.80.

A representative of another company said that the operating cost of automatic electric heaters is almost prohibitive, even though a switch is placed between the heater and the line so that the heater can be operated manually as well as automatically. Because of the automatic feature, people are inclined to be extravagant and do not give the proper attention to the cutting on and off. This man states that he does not mean that the automatic heater cannot be operated economically, but that it is not being done.

Thirty-day tests conducted by another company on heaters are given in Table II. The tests were made during the months of December and January, those on automatic and non-automatic being conducted on the same installation so that the proper comparison could be made.

With reference to what is necessary to get central-station salesmen and consumer acceptance of water-heating devices, the inquiry made by the committee among the central-station companies in the Southeast reveals the following:

1. More educational advertising of the manufacturers in trade and technical journals and general publications.

2. Complete instructions of salesmen on sales methods.

3. Selling the idea of the necessity of tank insulation.

4. Energy rate that will permit operation at a cost that is not excessive and only slightly more than for other types of fuel.

Utility Uses Fourteen Languages to Notify Stockholders of Meeting

NOTICE TO SHAREHOLDERS ANNUAL MEETING March 11, 1927	
Bekanntmachung an Aktionären Jahresversammlung Den 11 März 1927.	Avis Aux Actionnaires Assemblée Annuelle Le 11 mars 1927.
ΓΝΩΣΤΟΠΟΙΗΣΙΣ ΤΩΝ ΜΕΤΟΧΩΝ ΕΤΗΣΙΑ ΣΥΝΕΛΕΥΣΙΣ ΜΑΡΤΙΟΥ 11 1927	נאטיס צו גי שערהאלדערס יעהרליכער סיטינג מארטש דעם 11, 1927
Avviso agli Azionisti Riunione Annual 11 Marzo 1927	Zawiadomienie do akcjonarjuszów: Roczne posiedzenie 11-go marca, 1927.
[illegible] 11 МАРТА 1927 ГОДА.	A Részvényesek Figyelmébe Evi gyülés 1927. márczius 11-én.
Kennisgeving aan Aandeelhouders Jaarvergadering 11 Maart 1927.	"Huom! Ilmoitus osakkeenomistajille: Vuosikokous maalisk. 11 pv. 1927."
Upozornění Podílníkům! Výroční schůze koná se 11. března 1927	Tillkännagivande Till Aktieägare Årsmöte Den 11 mars 1927.
[illegible]	

TIME OF MEETING—THREE o'CLOCK P. M.
PLACE—ILLINOIS POWER BUILDING
ASSEMBLY ROOM
Capital Avenue at Fourth Street

ILLINOIS POWER COMPANY
Arthur D. Hodin, Vice President

THIS advertisement, placed in the newspaper of a Middle Western city recently, demonstrates the extraordinary care taken by one utility to be sure that the proper notification of its annual stockholders' meeting reached all those who should have been informed.

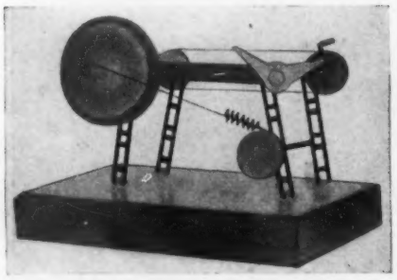
Advertising the "Third Step"

A BLIND advertisement, with something of the mysterious appeal of the title of a detective novel, opened the "third step" campaign of the Northern States Power Company in Minneapolis, St. Paul and 130 other newspapers throughout the Northwest. After public interest had been aroused by the question, "What do you know about the third step?" seven following advertisements appeared at intervals of 30 days. The first of the seven explained the third rate step, bringing out the fact that, after normal use of energy for lighting and small appliances had been made, a less than 3-cent charge per kilowatt-hour enabled the customer to take full advantage of the conveniences of larger electrical household devices. The second advertisement put the question, "And now that you know what

BLIND AD INAUGURATING "THIRD STEP" ADVERTISING CAMPAIGN

the third step is, what are you going to do about it?" The remainder of the series influenced the answer to that question by bringing out in greater detail the manifold economies, conveniences and labor- and time-saving virtues of electrical cooking, refrigeration, ventilation, washing, ironing, etc.

Mechanical Device Aids in Explaining Power Factor



A PHYSICAL sense of what power factor means is conveyed to the layman by the device illustrated above, designed by R. W. Adams, manager of the Providence office of the General Electric Company. It has been used effectively in persuading power customers to engage in the purchase and installation of corrective apparatus by L. M. Duryee, service engineer of the South County Public Service Company, Westerly, R. I. The device consists of a flywheel driven by an elastic band and crank. When turned continuously in one direction, the flow of energy to the flywheel corresponds to the supply of direct current to an inductive load. When the crank is oscillated, the energy required to overcome the mechanical inertia associated with reversing the flywheel corresponds to the magnetic inertia of an alternating-current inductive load, the flywheel speed (current) lagging behind the application of the force (e.m.f.) at the crank. By attaching the cord and spring shown in the foreground to the flywheel, correction is made for this inertia, corresponding to the introduction of capacitance into the circuit. In one case the power customer ordered a 350-kva. synchronous motor-generator for corrective purposes on the strength of a demonstration by this device.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

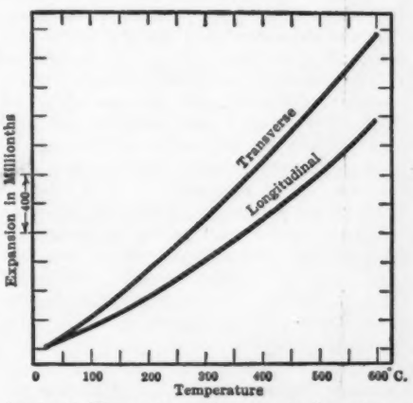
Surface Condensers in Steam Power Plants.—J. A. POWELL and H. J. VETLESEN.—The purpose of this paper is to tell how a study is made by means of which the most economical condenser installation for a given power plant can be determined. As it is not the aim to discuss the advantages or disadvantages of the various makes of condensers, the study is based, according to the authors, upon an average heat transfer which actually has been obtained in condensers of different makes and under normal operating conditions. As a basis for this study the authors have taken a normal load of 26,000 kw. on a 30,000-kw. turbo-generator, bled at two stages for preheating of the feed water to 212 deg. F., the turbine giving a yearly output of 100,000,000 kw.-hr. The variation in steam supplied to the turbine of 26,000 kw. load with change in vacuum was found and plotted as a water-rate curve. The calculation of the vacuum which can be obtained with a condenser is based on the heat transfer obtained with tubes in normal operating condition, and not on the heat transfer obtained with absolutely clean tubes. This heat transfer, express in B.t.u. per square foot per degree Fahrenheit per hour varies with the inlet temperature of the circulating water, with the velocity of the water in the tubes and with the tube arrangement and design of the condenser. Actual performance data on heat transfer to the tubes in normal operating condition were gathered for different makes of condensers, and curves were worked out giving the average values found at different inlet water temperatures. According to the authors, the conclusions from their studies are that where sufficient circulating water is available the most economical condenser installation for a unit is a single-pass condenser for which the ratio of square feet of surface to normal kilowatt output of the turbine it serves is not higher than about 0.77, with higher water temperatures in the installation of the smaller condensers justified only at higher water velocities. At 60 deg. F. water temperature the installation of a surface condenser with a ratio of surface to kilowatt output of 0.77 is justified for water velocities through the tubes of about 5.75 ft. per second and at 70 deg. F. water temperature for water velocities of about 6.25 ft. per second. The most economical surface condenser installation thus found is considerably smaller than that actually installed in modern power plants.—*Mechanical Engineer*, May, 1927.

Strength of Pipe Flanges.—E. O. WATERS and J. H. TAYLOR. — Higher pressures and temperatures have led to several studies of piping layout and design preliminary to actual construction. At the same time, there is an insistent demand for uniformity and simplification lest the development of new styles of fittings to meet new conditions should lead to wasteful multiplication of parts carried in stock as standard. In the field of flange fittings much has been accomplished in standardization, but apparently little has been known and less published in regard to the actual strength of the flanges, or as to whether the proportions agreed upon as standard are really the best, from the standpoint of strength and economy, for a designated purpose. The American Spiral Pipe Works have, therefore, begun a study of this subject, and the present paper undertakes to show the results which have been obtained as far as flat flanges or rings are concerned and to demonstrate an extension of the theory to include flanges with hubs, with accompanying tests.—*Mechanical Engineering*, Mid-May, 1927.

Specific Characteristics for Hydraulic Turbines.—ARNOLD PFAU.—This article deals with the mathematics of a suggested new expression for specific speeds that is non-dimensional and embraces the three fundamental characteristics of a turbine, namely, peripheral speed, velocity of flow and efficiency.—*Mechanical Engineering*, Mid-May, 1927.

Units, Measurements and Instruments

Thermal Expansion of Graphite.—P. HIDNERT and W. T. SWEENEY.—This paper gives the results of an investigation on the thermal expansion of longitudinal and transverse sections of artificial graphite electrode (99.2 to 99.7 per cent carbon) over various temperature ranges between room temperature and 600 deg. C. A summary of available data by previous observers on the thermal expansion of graphite (natural and artificial) and of other forms of carbon is included. In the present investigation the coefficients of expansion of graphite were found to be low. The transverse samples expand considerably more than the longitudinal samples (approximately 45 per cent). For both the longitudinal and transverse samples the coefficients of expansion decrease slightly as the purity or carbon content increases.—*Technologic Papers of Bureau of Standards, No.* 335, Feb. 18, 1927.



AVERAGE EXPANSION CURVES OF ARTIFICIAL GRAPHITE (LONGITUDINAL AND TRANSVERSE DIRECTIONS)

Generation, Control, Switching and Protection

Kings River Plant Added to Central California Power System.—J. W. JOURDAN.—This article presents construction details of the 33,000-kva. Balch plant of the San Joaquin Light & Power Corporation, which was completed and dedicated to public service January, 1927, almost exactly 22 months after construction was authorized. Construction economies effected by the San Joaquin men in active charge of this project are discussed with intimate details by the author.—*Electrical West*, May, 1927.

Transmission, Substations and Distribution

Poles for High-Tension Overhead Lines and Line Suspension.—A. CLAUSS.—A variety of types of poles employed in engineering practice for high-tension overhead lines and their method of suspension are described and illustrated in this article. The use of ever-increasing voltages for the transmission of electrical energy in bulk has, in the course of time, produced a number of types of pole, each of which has been developed to suit the span found by calculation to be the most economical. For the larger spans—necessitated for economical reasons and involving greater distances between the conductors, one above the other—iron and concrete material, which could be highly stressed and provided a longer life, are now employed. The arrangement of conductors on a horizontal plane requires that the cross-arms of poles, especial'y in the case of a pole with six conductors, be of considerable length; consequently, the breaking of one of the conductors—the outer conductor especially—will subject the pole to a high torsional moment, to withstand which the pole is not normally designed. The author discusses details, designs of poles and use of different materials to meet this and similar conditions of service. — *A.E.G. Progress*, April, 1927.

Heat Applications and Material Handling

High-Speed, High-Frequency Inductive Heating.—E. F. NORTHRUP.—High-frequency inductive heating permits of almost unlimited speed in heating a continuous conducting mass. A new 300-lb. commercial-alloy melting furnace is described. It is especially designed for melting ferrous alloys. Power is supplied by a 150-kva. generator at 1,920 cycles and 900 volts. The very rapid heating gives a very high melting efficiency. Various examples are cited and efficiency calculations appended.—*Paper presented before American Electrochemical Society*, April 28, 1927.

Thermit and Icebergs. — H. T. BARNES.—The temperature balance between ice and water is most delicate. When the equilibrium is upset a minute fraction of a degree, sometimes too small to be recorded on a sensitive

thermometer, one phase will pass over to the other. The true freezing point of water has to be defined as an intimate mixture of ice and water neither gaining nor losing heat. In large ice accumulations of lakes and rivers the only difference between ice masses tightly bound and the same loose and soft is no more than a thousandth of a degree. Large temperature changes in the system are impossible, for the velocity of transformation is rapid enough to prevent supercooling or superheating to any great extent, according to the author. This paper deals with practical applications of heat to compensate this small temperature effect which have been made to prevent ice accumulations. It is shown that ice prevention requires considerably less actual heat than getting rid of ice after it has formed. Heat has been applied in the form of steam or electrical energy with varied success, but with the great development of hydro-electric power in recent years, involving large turbines and volume of flow, more powerful methods of ice control have become necessary. The use of dynamite and other explosives for ice fighting is limited to open areas away from settled communities and fixed structures, and is resorted to not as a preventive measure, but as a last resort in emergency. The author discusses in detail the use of thermit heat units for ice control and cites a number of specific experiments which have been conducted in the last year.—*Journal of Franklin Institute*, May, 1927.

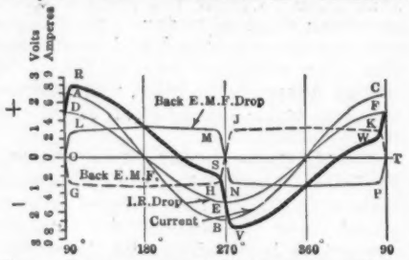
Traction

Great Northern Using Alternating-Current Trolley and Motor-Generator Locomotives.—This article deals with the electrification now under way on the Great Northern Railway. Involved in present construction are a 110-kv., three-phase, 60-cycle transmission line, the erection of new outdoor substations, a 13.2-kv., 7,500-kva. frequency-changer set in a Skykomish station where connection is made with a three-phase, 110-kv. transmission line of the company, and a 44-kv., single-phase, 25-cycle railway transmission line from Skykomish to Tumwater. Later and as required a second 44-kv. railroad transmission line will be added, a second frequency-changer installed at Skykomish and still another frequency changer installed at either Tumwater or Wenatchee. Special features of design of the frequency changers include the use of automatic voltage regulators to take care of power reversals during periods of regenerative braking, motor-operated stator shifters to care for phase-shift conditions incident to the fact that two widely separated 110-kv. transmission lines will be tied together through the machines, and spring mounting of the stators to reduce vibration of the single-phase machines.—*Electrical West*, May, 1927.

Diesel Traction for Railroads.—WILLIAM ARTHUR.—This article presents a general consideration of the problem of applying Diesel locomotives to railroad service, outlines the advantages which may be obtained and cites operating, design and construction problems to be met. General conclusions are drawn by the author favoring the adoption of Diesel-electric traction. — *Mechanical Engineering*, Mid-May, 1927.

Electrophysics, Electrochemistry and Batteries

Law of Alternating-Current Electrolysis and the Electrolytic Capacity of Metallic Electrodes.—J. W. SHIPLEY and CHAS. F. GOODEVE.—The investigation was undertaken to determine the condition under which explosive gases are produced in electric boilers. In alternating-current electrolysis a critical current density below which no electroyltic gases were evolved was determined for seven metallic electrodes when the conditions of frequency, temperature, pressure, voltage and electrolyte were maintained constant.



PHASE DIFFERENCE AND DISTORTION OF WAVE FORM PRODUCED BY BACK EMF. OF AN ELECTROLYTIC CELL

Above the critical current density alternating-current electrolysis was shown to follow the law of direct-current electrolysis. It may be made coincident with it by subtracting the critical current density from the current density employed. The existence of a critical current density is credited to an electrolytic capacity of the electrodes to store up the products of electrolysis. Direct determinations of this capacity have been made. The electrolytic capacity was shown to be dependent upon the nature and condition of the electrode surface. The relation of the back emf. to the quantity of electricity passed was determined and was related to the wave of the alternating-current, producing a phase difference. The elimination of the production of explosive gases in electric boilers may be secured by a design of an electrode chamber in which the current density is constant and below the critical point.—*Paper presented before American Electrochemical Society*, April 28, 1927.

Short-Circuited Cell for Electro-Organic Reductions.—C. J. BROCKMAN.—A zinc-amalgam anode in sulphuric acid is connected to a platinum cathode in sulphuric acid or sodium hydroxide solution using a divided cell. This short-circuiting of the anode to the cathode causes an evolution of hydrogen on the cathode at a small current density and a low potential. Reductions can be carried on, according to the author of the paper, by the use of this cell. A description is given of the equipment and some of the experimental work accomplished with it.—*Paper presented before American Electrochemical Society*, April 28, 1927.

Principles of Electrolytic Studies on Corrosion.—W. BLUM and H. S. RAWDON.—An apparatus and method are described in this paper by which the potential, excluding *IR* drop, is measured between two plane parallel plates of the same metal immersed in a given solution and completely filling the cross-section of the vessel. The results may be plotted in the form of current-density potential curves, or loss in weight potential curves, or penetration potential curves. Such curves for a number of metals in different solutions yielded results that in general were consistent with the behavior of the metals in simple immersion.—*Paper presented before American Electrochemical Society*, April 28, 1927.

Telegraphy, Telephony, Radio and Signals

Analyzer for Complex Electric Waves.—A. G. LANDEEN.—The analyzer described is capable of working over a range from about 3,000 cycles to 100,000 cycles. A requirement of this design was that a very high resolution be obtained. To assist in accomplishing this end the frequencies under study are translated downward in the frequency scale to the resonating element, which consists of a circuit tuned to 800 cycles. This downward translation increases the percentage difference of frequency separation of the components under study. Because of the great range of frequencies covered by the analyzer it is not possible to have sum and difference terms other than those of the second order which fall outside of the range of sensitivity of the resonator. The modulator has therefore been so designed as to preclude formation in the higher-order terms. To increase its discrimination, the analyzer makes use of two tuned circuits and amplifiers arranged in tandem and placed before the modulator.—*Bell System Technical Journal*, April, 1927.

Miscellaneous

"Cementless" Slotted Insulators.—M. BUCOV.—The slotted insulator is a cap insulator which is similar to other insulators of this well-known type in dimensions and electrical properties. It is so constructed that the stalk and the cap can be fixed without the employment of cement. This allows both these parts to expand as the temperature changes, without affecting the mechanical properties of the insulator. The insulator head contains a hollow space, the upper part of which is of spherical shape and is accessible from the outside through a slot. A spherical-shaped nut can be inserted through the slot and pushed into the hollow space. It is then turned about until its spherical surface comes into contact with the appropriate supporting surface in the porcelain. The nut is provided with an elastic cover so that the porcelain does not rest directly against the metal. This elastic cover is intended to equalize any small irregularities in the porcelain. The nut is also fitted with a projection which fits into the slot so that it cannot turn when the stalk is being screwed up. The article deals in some detail with the tests to which these insulators are subjected in determining the advantages of this design.—*A. E. G. Progress*, April, 1927.

News of the Industry

On the Mississippi River

Reports of Light and Power Service Maintained Against Great Odds Continue to Come In

LOUISIANA is now in its turn bearing the brunt of the conditions caused by the great flood on the Mississippi River. While the tremendous acreage overflowed in that state is mainly agricultural and sugar land, there has been much for electric lighting companies to do, and as in the other stricken states they have risen splendidly to the emergency. The New Orleans Public Service, Inc., made a record by installing 600 lamps on the levees in eight hours; it used its fleet of trucks and drivers to bring to the city refugees from the parishes affected by the artificial crevasse made below the city, and it is serving in numerous ways in flood relief.

C. J. Pope, who is general manager for the Louisiana Ice & Utilities, Inc., at Bunkie, La., is in charge of levee work along Red River, and every man that could be spared is on levee work and guard duty. The main generating plant of the company, which supplies by transmission lines every town in that section, was prepared against floodwaters; poles were extended in height, and branch ice and soda plants were stocked so that the communities would not suffer if power was cut off.

The Mississippi Power & Light Company, serving 90 towns in Mississippi, many of them, including Greenville, in the flooded section, has given constant electric service over its transmission lines from the Sterlington (La.) gas-fired plant. The Louisiana Power & Light Company, serving 30 towns in Louisiana's overflowed section from the same plant, has the same record, as has the Arkansas Power & Light Company, the parent concern, serving dozens of communities in its state.

Harvey C. Couch, president of these companies, is flood relief dictator in Arkansas. Every local manager is subject to Red Cross orders. Airplanes and boats patrol the trunk lines and keep service intact. Energy is furnished for levees, camps and emergency pumps, and gas for camps. Mr. Couch has formed a million-dollar rehabilitation corporation for the State of Arkansas. The stock was promptly subscribed in full and the plan worked out by Mr. Couch has been adopted by the government for co-operation with the other states of the stricken district. Under the Couch plan loans in whatever amounts are necessary will be made directly to farmers and others requiring them.

Municipal and small isolated generating stations have in many instances failed to render service under flood conditions. Shortage of fuel and inability to obtain power over transmission lines from more favorably situated plants are given as the reasons. The Yazoo City (Miss.) municipal plant is reported to be one that went out of service.

One fact of significance connected with electric service to flood towns is that the total load did not drop greatly, even though many generating plants had to close down for a few days. Some attributed this to the greatly increased amount of pumping taking place. A check on the daily load curves at Little Rock, Ark., in which a representative of the ELECTRICAL WORLD participated, made before and during the worst part of the flood, showed that though the peak load was materially reduced, the daily output was virtually the same as for corresponding normal days.

Princeton Lays Cornerstones for Technical Buildings

Scientists, statesmen and educators gathered at Princeton, N. J., on May 12 to take part in laying the cornerstones of the new two-million-dollar engineering and chemistry laboratories of Princeton University. The ceremony took place before a large crowd at the corner of Washington Road and William Street.

John Grier Hibben, president of the university; A. Harry Moore, Governor of New Jersey, and Dr. Michael I. Pupin of Columbia University, former president of the American Institute of Electrical Engineers, paid tribute to Princeton's share in promoting modern science. Dean Arthur M. Greene, Jr., of the Engineering School and Prof. Hugh S. Taylor of the department of chemistry also spoke.

Dr. Pupin said: "The same eternal truth which, according to the prophets, promises spiritual freedom promises today economic freedom. American industries are craving today for the revelation of scientific truth, and the only problem which faces us is the problem of the training of our generation in the science and in the art of revealing new scientific truth. Pure science research and the engineering discipline which will apply efficiently the findings of pure science to the development of our industries and of our daily life is now our national motto; it is the motto of our universities as well as of our industries."

In outlining the Princeton view of engineering training, Dean Greene said: "Engineering as we conceive it cannot be divorced from man or men, and he can serve best who is trained to handle himself and think of others in relation to the physical structure on which he is engaged."

Tributes were paid to the memory of Joseph Henry.

The new buildings are designed to be in the English collegiate Gothic style of architecture to harmonize with the other buildings on the campus. The engineering building will be two stories high and contain 72,000 sq.ft. of floor space, while the chemistry building will occupy a smaller area but will be three stories high.

Interconnection Wins Against Tornado

In Poplar Bluff, Mo., with Distribution System Wrecked and Smokestack Blown Down, Service Continues Uninterrupted, Although City Lies in Ruin

MISSOURI and Arkansas, struggling to regain their normal footing after a visitation from the Mississippi flood, were hard hit again on May 9 by tornadoes. These formed part of a series that took place in a territory stretching from Michigan as far south as Texas and as far west as western Kansas. The greatest injury was probably in Missouri, and the city most heavily stricken in that state was Poplar Bluff, a place of 9,000 inhabitants which suffered a loss of 70 lives, 300 persons injured and $2,500,000 damage to property, mostly in the business district.

Transmission lines in the neighboring territory stood up well or escaped the path of the storm, but the generating plant of the Missouri Utilities Company at Poplar Bluff was put out of operation when a 40-ft. section of the smokestack blew down. The company's distribution system in the heart of the stricken district was so completely wrecked that it had to be virtually rebuilt. Once again the value of interconnection was shown, and within 27 hours the company had restored service to 90 per cent of its customers by means of energy from its Cape Girardeau plant. Not at any time was the company without electricity at the wrecked city. An addition of about 40 emergency employees to its permanent maintenance force helped to achieve the remarkable record. It is estimated that $15,000 will cover the damage done to the company's system. Its office and showroom were wrecked, but none of its employees was injured.

In restoration of service there was no distinction made between customers of the Missouri Utilities Company and customers of the local municipal plant. Wherever the company found it possible to serve a customer of the municipal plant to greater advantage than could the municipal plant the service was given through the municipal meters. The company and the municipal plant worked as one in a superhuman effort to restore service. They have about an equal number of customers

in the city. It was announced that the demolished smokestack of the generating plant, which escaped any other injury, would be rebuilt by May 20.

The value of interconnection had already been demonstrated in this district during the flood of April, when East Prairie and Lilbourn, towns served by transmission lines of the Missouri Utilities Company, were inundated. Although water was several feet deep in the streets of these towns, electric service was uninterrupted at all times. On the other hand, in flooded towns which depended for electricity upon local generating stations service broke down. In New Madrid, for instance, where about 1,800 of 2,000 inhabitants were forced to vacate their homes, the officials of the municipal plant were obliged to pick up the generating machinery with pulleys and raise it above the inflowing waters. When the waters subsided the machinery was restored to its foundation and service resumed.

Damage estimated at $50,000 to the electrical distribution system of the Illinois Power & Light Corporation in Decatur, Ill., followed a storm of cyclonic proportions on the afternoon of May 9. Transmission lines into the city from the north and west escaped, but a thousand homes, stores and factories in the city were cut off for a few hours and dozens of emergency crews worked through the night restoring service. The east side of the city was hardest hit.

Inquiry made of the electric power transmission companies, telephone and telegraph companies operating in the territory around Dallas, Tex., which was recently visited by cyclones, reveals that comparatively little damage was done. At Garland short sections of pole lines were blown down, but these were quickly repaired. The storm area was small and the damage was altogether local, amounting all told to only a few thousand dollars, with service quickly restored.

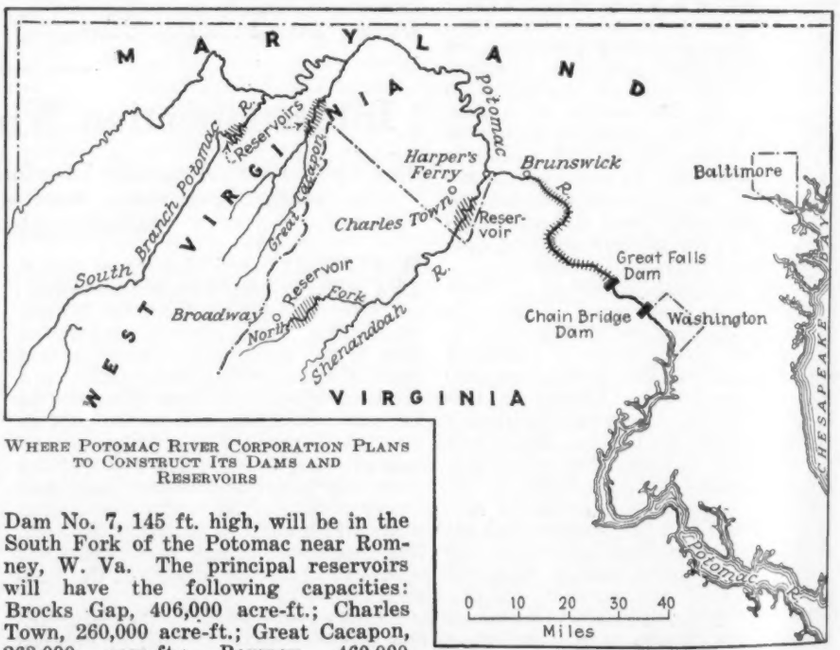
Another Big Hydro Project Looms in Sight

Cleveland Men in Association with the Byllesby Interests Plan Development on Potomac, Shenandoah and Great Cacapon Rivers, Taking in Great Falls of Potomac

FOR years much has been heard about hydro-electric development on the Great Falls of the Potomac, 10 miles northwest of Washington, and battles over the disposition of the site have been waged in Congress, advocates of public ownership like Senator Norris of Nebraska demanding that the falls be used for a government plant to serve the city of Washington. In the same period disconnected items have from time to time found their way into the press describing more or less mysterious surveys on the Potomac and Shenandoah Rivers in the vicinity of Harpers Ferry, W. Va., carried on by hydro-electric engineers in the interest of water-power development by the Potomac River Corporation of Wilmington, Del., represented at the power site by James R. Gloyd of Cleveland.

A new aspect was given to both projected enterprises on May 13, when application for a three-year preliminary permit for an extensive and costly hydro-electric project on the Potomac River, designed to supply electricity to Baltimore, Washington and adjacent territory, was filed with the Federal Power Commission by the Potomac River Corporation, of which Robert J. Bulkley, a Cleveland attorney, was named as president and Mr. Gloyd as vice-president. The application was filed by Charles Keller of Chicago, representing H. M. Byllesby & Company, and it was stated that the Byllesby company would have a half interest in the enterprise, the other half to be held by the Cleveland group.

A total output of 750,000,000 kw.-hr. a year can be obtained, the applicant estimates, from a series of seven dams. One is to be at Chain Bridge, near Washington. It will be 115 ft. high. A second dam, 100 ft. high, will be at Great Falls, 10 miles above. Dam No. 3, 50 ft. high, will be at Harpers Ferry; Dam No. 4, 130 ft. high, will be at Charles Town, W. Va., in the Shenandoah River; Dam No. 5, 213 ft. high, will be at Brocks Gap, Va., in the North Fork of the Shenandoah; Dam No. 6, 226 ft. high, will be near the mouth of Great Cacapon Creek, while Dam No. 7, 145 ft. high, will be in the South Fork of the Potomac near Romney, W. Va. The principal reservoirs will have the following capacities: Brocks Gap, 406,000 acre-ft.; Charles Town, 260,000 acre-ft.; Great Cacapon, 263,000 acre-ft.; Romney, 460,000 acre-ft.



WHERE POTOMAC RIVER CORPORATION PLANS TO CONSTRUCT ITS DAMS AND RESERVOIRS

The plan of development is identical with that proposed in the report made for the Federal Power Commission by Colonel Max Tyler in 1921, with the exception that dams are added at Harpers Ferry and at Charles Town. This will make it possible to increase the installed capacity from 180,000 kw. to 225,000 kw. The cost under the Tyler plan would have been $44,000,000. As extended by the Potomac corporation, the cost is expected to be $57,000,000. The power is not expected to be available for five to eight years.

A number of detailed reports on the water-power possibilities of the Potomac have been made at the request of Congress. The Senate three times has passed a bill providing for the construction of a plant at Great Falls by the government. In the House of Representatives the position has been taken that as only a small part of the output would be required by the federal establishment there is nothing to justify the government's going into the power business. As Congress apparently is deadlocked on this proposition, it is expected the Federal Power Commission will be disposed to grant the present application for a preliminary permit, unless there should be some indication of early action on the part of Congress looking to the disposition of the government ownership proposal.

General Charles Keller, now of the engineering department of the Byllesby Corporation, in the course of his many years of service with the Corps of Engineers and as Commissioner for the District of Columbia, became familiar with the possibilities of the Potomac for power development.

STRONG OPPOSITION CERTAIN

Strenuous opposition to the application is sure to manifest itself in Congress and out. Senator R. B. Howell of Nebraska has come out with a statement that it would be "a political, economic and social crime to permit private development of the Potomac's electrical power possibilities." The Federal Power Commission has quieted some excited apprehensions by pointing out that opponents will have ample opportunity to be heard. Power from the talked-of plant could not, of course, be sold or transmission lines built in any state without permission of the state commission.

The power potentialities of Great

Falls alone have been estimated to be sufficient to take care of the needs of Washington and 1,500,000 persons in adjacent territory. Notwithstanding this, representatives of the Potomac Electric Power Company have more than once expressed a belief that electricity for its use can be developed on a more satisfactory basis by steam, particularly in view of the uncertainty of the flow in the Potomac.

Kanawha River Project

Subsidiary of Chemical Company Seeks to Build 50,000-Hp. Plant on West Virginia Stream

COINCIDENT with the visit of Major Daniel I. Sutton, United States Engineering Corps, and an inspection by him of the Great Kanawha River came the announcement from Charleston, W. Va., late last week that the New Kanawha Power Company has made application to the Federal Power Commission for a preliminary permit for the development of hydro-electric power on the river between Charleston and Montgomery and the erection by the company of a power dam between Montgomery and Deepwater. The power company is a subsidiary of the Union Carbide & Carbon Corporation and has headquarters at Glen Ferris, W. Va.

The sites applied for are those where the War Department engineers have proposed that the federal government replace locks and dams Nos. 2, 3, 4 and 5 with new locks and dams at Nos. 3 and 5. Should the third dam be built and the federal government build a lock through it, navigation on the Kanawha River will be extended as far as Kanawha Falls. The fall of 63 ft. is to be developed in three stages. It is proposed to install initially 8,000 hp. at each of the three sites, but the installation ultimately is to be increased to 65,000 hp. The power is intended for electrochemical and electrometallurgical uses and for general distribution.

The New Kanawha Power Company has also filed a declaration of intention with the Federal Power Commission to develop hydro-electric power on the New River between Gauley Junction and Hawk's Nest, where it is said 30,000 hp. is available. No application has yet been made to the authorities of the State of West Virginia with respect to state licenses for either of these power projects in view of the uncertainty of legislative action on the subject of water-power development in the state.

Great Lakes Geographic Division Elects Officers

Thomas F. English, general manager of the Indiana & Michigan Electric Company, South Bend, Ind., was elected president of the Great Lakes Geographic Division, National Electric Light Association, for the coming year, effective July 1, at the annual meeting of the conference delegates of the division held at Chicago last week. John K. Swanson, district manager of the Consumers Power Company, Saginaw, Mich., was elected a vice-president. Other vice-presidents chosen are J. E. Johnson, vice-president Illinois Power & Light Corporation, Chicago, and George H. Willmarth, manager Northern States Power Company, Eau Claire, Wis. R. V. Prather, Springfield, Ill., was re-elected secretary-treasurer.

Plans of the division, which includes Michigan, Indiana, Illinois and Wisconsin, announced at the meeting as adopted for the coming year include encouragement of the construction of high-voltage interconnecting lines between various electric systems. The Power Survey committee of the division, which recently in co-operation with United States Army engineers completed a study of the present and future energy requirements of the Great Lakes region, reported that it is extending its study to the electric systems of Ohio, Kentucky and West Virginia.

How Texas Companies Are Serving Oil Wells

Important economic benefits have come to the oil industry of Texas during the last few years by extensions of electric power transmission lines into the different producing fields. The use of this power in oil-well operations has become general and is serving to increase materially the income of power companies. The Gulf Public Service Company, a Philadelphia corporation, was quick to respond to the power possibilities of the recent discovery of an oil pool in Cherokee County. It owns the electric power plant at Jacksonville, 12 miles from the new well, and a 1,500-kw. unit will be immediately added to this plant and a power transmission line constructed to the prospective oil field. Other extensions will be made by the company as demands may arise.

Confirming a report that the Texas Electric Service Company will construct 150 miles of high-tension power transmission lines in west Texas, John W. Carpenter of Dallas, vice-president and general manager of the company, said a few days ago that the company's transmission lines will be extended to the new town of Crane City, in Crane County; to Monahans and Pyote, in Ward County, and also will serve the oil field in Winkler County. Local electric light and power service already has been established in these towns. Approximately 90 miles of the new lines will operate at 132 kv., the highest voltage now used in Texas, while the remainder of the line will operate at 60 kv. A 132-kv. line being built westward from Eastland will be supplied with energy from the generating station at that place, which is being increased from a capacity of 22,000 kw. to 37,000 kw. by the addition of a 12,000-kw. steam-turbine unit. The company is also constructing 100 miles of 60-kv. transmission lines between Breckenridge and Wichita Falls and the nearby oil fields.

The Texas Electric Service Company recently purchased the power systems as Odessa, Midland and Stanton and is building 125 miles of transmission line to link these units with Big Spring, which is tied in with Sweetwater and other central west Texas towns. Its new lines will extend across Upton County to the Upton-Reagan county line. A connection with the West Texas Utilities Company will be made at the latter point. The latter company is building west from San Angelo to the Big Lake field and also to the McCamey-Hurdle district, which centers on the lower end of the Crane-Upton county line.

N.E.M.A. Adopts Program

Those in Charge Have Sought to Unite Competent Speakers and Pertinent Topics

FOR the first annual meeting of the National Electrical Manufacturers' Association, scheduled for Hot Springs, Va., May 30-June 3, a program has been arranged which has kept in mind the two requirements of providing speakers thoroughly qualified to discuss the subjects assigned to them and selecting subjects pertinent to the objects which the association has been formed to promote. Among the speakers obtained, besides President Swope and other association officers, are General Herbert M. Lord, Director of the Budget, President R. F. Pack of the National Electric Light Association, William McClellan, former president of the A.I.E.E.; Admiral Bullard and Commissioners H. A. Bellows and O. H. Caldwell of the Federal Radio Commission; Dr. E. A. White, chairman of the National Committee on the Relation of Electricity to Agriculture, and Earl Whitehorne, commercial editor of the ELECTRICAL WORLD. Entertainment will be furnished in abundance. The program follows:

MONDAY, MAY 30

Morning. — Department of Commerce committee. Supply Division sections: Lamp receptacle and socket, air circuit breaker, wire and cable, snap switch, attachment plug. Apparatus Division sections: Large motor, switchboard. Radio Division sections: Sets, parts, membership, antenna, apparatus, broadcasting, socket power, antenna devices, publicity.

Afternoon.—Sports.

Evening.—First General Session: Presidential address, Gerard Swope; "Nema and the New Market," Earl Whitehorne, followed by discussion.

TUESDAY, MAY 31

Morning.—Supply Division sections: Signaling apparatus, laminated phenolic products, non-metallic conduit, fuse, armored conductor. Apparatus Division sections: Oil circuit breaker, small motor, industrial control, transformer, electric welding, electric measuring instrument. Radio Division committees: Dry battery, aural devices, storage battery, special-purpose tube, transmitter tube, cabinet, receiving tube, condenser.

Afternoon.—Sports.

Evening.—Banquet: Admiral W. H. G. Bullard, R. F. Pack, General Herbert M. Lord, Director of the Budget, on "The Nation's Business."

WEDNESDAY, JUNE 1

Morning. — Supply Division sections: Electrical porcelain, vulcanized fiber, heating appliance, overhead trolley-line materials, rigid conduit, industrial lighting, knife switch, metal molding. Apparatus Division sections: Switching equipment, motor and generator, mining and industrial locomotive, electric measuring instrument, power switchboard and switching equipment. Radio Division: General meeting; election; "Radio Standardization," R. H. Manson; "Socket-Powered Radio," W. E. Holland; "Value of Broadcasting to the Public," G. F. McClellan.

Afternoon.—Sports.

Evening.—Second General Session: "Results of Business Policies Questionnaire," N. A. Wolcott; "How Much Does It Cost?"

S. L. Whitestone; "Putting Price in Its Place," Alfred E. Waller; "Three Million New Customers," E. A. White; address, O. H. Caldwell.

THURSDAY, JUNE 2

Morning. — Supply Division sections: Electric range and water heating, nonmetallic sheathed cable, molded or formed insulation, enameled steel reflector, panelboard and switchboard. Apparatus Division sections: Small motor, large motor, power switchboard and switching equipment. Radio technical committees: Transmitter, receiver, battery and socket, vacuum tube.

Afternoon.—Sports.

Evening.—Third General Session: Address, H. A. Bellows; "What I Find in the Green Envelope," C. H. Pfingsthorn; "Methods, Money and Management," William McClellan; Nema hour committee, M. C. Rypinski.

FRIDAY, JUNE 3

Morning. — Supply Division sections: Panelboard and switchboard, outlet box. Apparatus Division sections: Motor and generator, mining and industrial locomotive, industrial control, transformer, electric welding. Radio Division: Technical, merchandising, statistical committees; "Loud-Speaker Characteristics," Irving Wolff; "Organization and Problems of National Broadcasting," A. N. Goldsmith; "Standardization Work on Vacuum Tubes and Methods of Measurement," L. A. Hazeltine; "Vacuum-Tube Developments," Francis H. Engel.

Utilities and Industrial Development

Their Part in Promoting and Serving Enterprises That Depend on Power Emphasized at Hot Springs Convention of Arkansas Utilities Association

A RAPID awakening by the State of Arkansas to a realization that its products should be taken to market in finished form rather than as raw material and the desire of the utility companies of the state to act as an alarm clock in hurrying this awakening, as well as to make the important contribution of electric power and other services to the coming industrial development—these are the principal impressions derived from the convention of the Arkansas Utilities Association which was held May 16 to 18 at Hot Springs. The general tone of the convention made it clear that the effect of the recent flood disasters has been to inspire with new ardor those who are preaching that the future progress of the state lies along industrial rather than agricultural lines.

Although this was a utilities convention, the subjects discussed in the general meetings and those taken by the men who made the addresses were not, strictly speaking, utility subjects. Nor were most of the speakers utility men except as they united with the utilities in the common effort to forward the progress of the state as a whole. This condition illustrated very forcibly the position of the utilities in the general picture and the important rôle in the development of the state which is conceded to them.

In his address to the convention Senator T. H. Caraway set forth in positive terms his own position in regard to the vociferously expressed disposition in some quarters to force the national government into private business, particularly the electricity business, as in the cases of Muscle Shoals and Boulder Dam. He characterized these projects as attempts to establish socialistic experiment stations. The Senator indorsed the operations of the Agricultural Credits Company, which seeks ot act as the local branch of the Federal Intermediate Credit Company in extending aid to farmers, particularly in the flooded regions. To get this organization started and to obtain the hoped-for federal aid, it was necessary that stock be taken up in the proportion of one-fourth of the company's lending power. H. C. Couch, president Arkansas Power & Light Company, sent telegrams to 21 utility operators outside the state asking for subscriptions. They immediately took up $100,000 in stock and offered to take more if the situation, in Mr. Couch's opinion, demanded it.

From the University of Arkansas came two speakers—W. N. Gladson, vice-president of the university and dean of the College of Engineering, and J. A. Dickie, professor of rural economics and sociology. The former emphasized the need for industrial development as a means of keeping native talent and genius in the home state. Dr. Dickie adduced facts and conclusions to show that efforts to promote progress in Arkansas through further agricultural development were doomed to failure and that the salvation of the state lay wholly in the growth of industry.

The president's address by Frank M. Wilkes of Pine Bluff and papers and addresses by F. B. Gardner on the textile industry in the South, by Charles Evans on promoting better understanding between communities, by Mrs. W. F. Lake on "The American Home and Its Health Standards," by G. C. Arnoux on "Reminiscences of a Radio Broadcaster," and by Martin L. Pierce on "The Utility Manager's Obligations," deeply interested the three hundred present at the convention. A well-performed playlet, written and staged by themselves, was put on by the women's club of the Arkansas Power & Light Company of Little Rock.

The officers elected for the ensuing year are: President, Robert M. Foster, Jr., vice-president and general manager Arkansas Utilities Company, Helena; vice-president, W. E. Bann, general manager Southwestern Gas & Electric Company, Texarkana; secretary-treasurer (re-elected), Rex I. Brown, commercial manager Arkansas Power & Light Company, Little Rock.

Wisconsin's Relative Position in Energy Production

The popular conception that water-power plants produce electrical energy more cheaply than the new type of efficient coal-burning plants is disproved by statistics compiled for Commissioner Adolph Kanneberg of the Wisconsin Railroad Commission. A survey of the cost of producing electricity by hydro-electric plants in that state shows that the average cost of one kilowatt-hour is 0.34 cent more than the cost of generating a kilowatt-hour at the Lakeside pulverized-fuel plant of the Milwaukee Electric Railway & Light Company. The average cost of firm power at the busbar of 23 hydro stations is 95 mills per kilowatt-hour.

Revised figures received from the United States Geological Survey show that water powers in Wisconsin generated 47.8 per cent of the total energy produced in that state last year. It was the greatest water-power year in her history. The study also reveals that Wisconsin has jumped in rank from ninth place to sixth in water-power production, displacing Pennsylvania and Idaho. The five states leading Wisconsin are California, New York, Washington, Montana and Alabama. Wisconsin produced 3.32 per cent of the aggregate national output. Wisconsin also made great gains in the total energy produced. At the end of 1925 it ranked tenth among the states, and at the end of 1926 it had reached eighth place, displacing Washington and West Virginia.

Michigan House Passes Savings Bank Investment Bill

After twice being defeated, a bill to allow savings banks to invest in the bonds of electric light and power and gas companies was taken from the table in the Lower House of the Michigan State Legislature last week and passed by a vote of 76 to 15. The measure, offered by Senator Jay Binning of Jackson, would amend the banking law by removing the restrictions on investments of savings banks so as to allow certain classes of public utilities to come within the law.

New British Electricity Acts Are Working Well

In his address to the shareholders of the City of London Electric Lighting Company, the chairman, J. B. Braithwaite, paid a tribute to the new acts of Parliament affecting the future of the electric power industry in Britain. The 1925 act, he said, settled the affairs of the London companies on a very satisfactory basis on the whole, although they were tied down closely in many directions. Already, he said, the East London group were interconnected and energy was passing between them, so that they were carrying out in practice the spirit of the act.

An application has been made by the London Power Company, Ltd., to the Electricity Commissioners for consent to the establishment of a generating station to carry out the purpose of the London electricity supply (No. 2) act, 1925. The site of the proposed station is about fifteen acres in extent and is between the south bank of the River Thames and the Great Western Railway freight station in Battersea Park Road. The London Power Company was formerly known as the London Electricity Joint Committee, Ltd., (1920). The constituent members of the company are the ten companies known as the West End group, which was responsible for the promotion of the London electricity supply bill.

Still Covets Private Lines

Los Angeles to Vote on Taking Over Gas & Electric System and on Harbor Site for Steam Plant

THE Los Angeles City Council on May 6 voted to place on the ballot at the general city election to be held June 7 an ordinance declaring the intention of the city to acquire the entire electric system of the Los Angeles Gas & Electric Corporation. Under the proposed ordinance the city may acquire this property either by direct purchase or by condemnation proceedings, the purchase price to be fixed by the California State Railroad Commission.

It is intended that this purchase shall include "lands, buildings, steam-electric generating plants [the company owns no hydro plants], substations, high-tension and low-tension overhead and underground lines and all rights-of-way, easements, interests, licenses and franchises in the city of Los Angeles." In addition to these properties, the ordinance provides for the acquisition of the Seal Beach steam generating plant of the company, which is in Orange County just across the county line between Los Angeles and Orange Counties. The transmission system between this plant and the city of Los Angeles and all lands and properties "used and useful" in connection with this plant or the transmission line are to be included in the sale. The ordinance further asks that the city attorney be directed to file with the Railroad Commission a petition to have the commission determine the amount of compensation the company shall receive and to institute condemnation proceedings in the Superior Court.

Champ Vance, vice-president of the Los Angeles Gas & Electric Corporation, said that until the resolution of the Council had been received and studied to determine just what it meant comment on it would not be made by the company. E. F. Scattergood, chief engineer of the Bureau of Power and Light of the city, denied that there was anything new in the Council's action. "As far back as 1922," said Mr. Scattergood, "the City Council adopted its first resolution empowering the city to request the State Railroad Commission to make a valuation of the electric generating and distributing properties of the Los Angeles Gas & Electric Corporation. Furthermore, the people have already voted to uphold these negotiations. In 1924 the voters by a big majority defeated a referendum ordinance which sought to halt valuation proceedings. When the valuation of the company's system shall have been determined by the commission, then the city will decide whether it desires to purchase this system."

The City Council has also ordered placed on the ballots at the general city election to be held June 7 a proposed ordinance which would provide for the leasing of certain harbor lands to the Los Angeles Bureau of Power and Light as a site for the erection of a municipal steam generating plant. The city has a contract with the Southern California Edison Company which provides that the city shall purchase from the company power needed over and above the amount which the city is able to generate in its own Aqueduct plants. An injunction prohibiting the use of the harbor lands for power-plant purposes has been obtained by the company, the court holding that this land had been transferred by the state to the city for harbor purposes exclusively. This latest move by the City Council has been interpreted as an attempt to legalize the use of the harbor lands in question for a power-plant site.

Purchases and Mergers

Activity in Minnesota and the Dakotas —Laclede Power & Light Is Sold —Vermont Plant for Foshay

BESIDES acquiring the Minnesota Power Company, serving ten communities on Lake Minnetonka, as already reported, the Northern States Power Company has recently taken over the Alexandria (S.D.) municipal plant, only two votes in the negative being recorded; the Hieb Electric Service Company at Marion, S. D., and the Atwater (Minn.) Light & Power Company.

The United Public Service Company of Chicago has bought the Northern Power & Light Company of Mobridge, S. D., from L. P. Runkel. The Northern Power & Light recently acquired the Java (S. D.) municipal plant.

Disposition of the Miles City (Mont.) municipal lighting plant to the Montana-Dakota Power Company, subsidiary of the Minnesota Northern Power Company of Minneapolis, for $377,000 is reported. (See ELECTRICAL WORLD for April 2, page 725.)

The Northwestern Public Service Company of Huron, S. D., has taken over the municipal electric plants at Wessington Springs and St. Lawrence, S. D.

Plants at Cando, N. D., and Farmington, Minn., have been acquired by the Drake-Jones Investment Company of Minneapolis.

The Laclede Power & Light Company, which was formed last January to operate the electric properties of the Laclede Gas Light Company of St. Louis, has, with its parent company, passed under the control of the Utilities Power & Light Corporation of Chicago. The Laclede company furnishes about 10 per cent of the electricity consumed at retail in St. Louis.

All properties, including hydro-electric generating stations and transmission lines, of the Clyde River Power Company of Richford, Vt., operating in the northern part of the state, have been purchased for the W. B. Foshay interests of Minneapolis by John J. Flynn of Vermont. The properties, it is reported, will be taken from Mr. Flynn by the Public Utilities Vermont Corporation, which is to be formed, and will furnish electric service to seven towns, including Richford. The Clyde River Power Company is understood to own several undeveloped power sites and water-storage sites.

Mills Brothers of Sodus, N. Y., who control the Lamoka Power Corporation of that place and the Sodus Gas & Electric Light Company, have agreed to purchase the Northern Cayuga Light & Power Corporation of Cato, N. Y., as soon as 90 per cent of the stock is available and the consent of the Public Service Commission is obtained.

The Central Georgia Power Company has purchased the municipal electric light, water, ice and cold-storage plant at McRae, Ga., for a reported price of approximately $150,000.

The Western Public Service Company has sold its distribution system in the city of Gering, Neb., to the municipality, which plans to secure energy at wholesale from the government Pathfinder dam at Guernsey, Wyo.

The Board of Commissioners of the Batesville (Ark.) Light and Water Improvement District were directed in an order issued last week by Chancellor Irby to execute a deed to the municipal water and light plant to the Arkansas Power & Light Company in consideration of $400,000 to be paid by the power company to the district. The mandatory injunction was issued following a hearing on suits filed by the power company and citizens of Batesville several months ago which were provoked by the action of the commission in voting, three to two, to sell the property to the Southern Edison Company after entering into an agreement to sell to the Arkansas Power & Light Company. The commission has the right to appeal to the Supreme Court.

The Public Service Company of Colorado has asked the Colorado Public Utilities Commission for permission to do business in Aurora, Brighton, Brush, Fruita, Hillrose, Hooper, Leadville, Ovid, Moffat, Palisade, Rifle and Sedgwick, Col., all places where it has within recent months bought the local plants.

Boise City, county seat of Cimarron County, Okla., by a large majority has voted to sell its municipal light and power plant to the Cimarron Utilities Company, which took possession May 1.

The Quebec Southern Power Corporation has acquired the hydro-electric plant at Donat, at the outlet of Lake Archambault, Quebec.

Bids Asked for the Ottawa-Toronto 220-Kv. Line

Bids have been called for, to be in the hands of the Ontario Hydro-Electric Power Commission in Toronto not later than June 1, for the construction of the projected high-voltage transmission line from the Ontario side of the Ottawa River, opposite Fitzroy Harbor, Quebec, to Toronto, a distance of about 200 miles. This transmission line will have a voltage of 220,000, the highest in Canada. One of the transmission lines from Niagara Falls to Toronto carries 110,000 volts, while the new line from the Saguenay River to Quebec City, which will soon be completed, will have a voltage of 187,000.

Work is proceeding at a good rate on the International Paper Company's hydro developments on the Gatineau River, which are to furnish the electrical energy for the new transmission line. The first of the five 24,000-hp. turbines at Farmers Rapids was "turned over" on May 9 and tried out. This plant, however, is not yet ready to go into commercial use. It is about a year and a half since the work started

on the Farmers Rapids plant. It is expected that the five 24,000-hp. units at this plant will be in operation before the end of the present year. Two units at the Chelsea plant, on the Gatineau River, have already been started.

Isle Maligne Line to Quebec

Shawinigan Company Finishes Erection of Towers for 187-Kv. System to Transmit 100,000 Hp.

ERECTION by the Shawinigan Water & Power Company of the steel towers for the new transmission line linking the Duke-Price Power Company's plant at Isle Maligne with the city of Quebec has been completed, and it is thought that by August the conductors will be on the poles ready to take the 100,000 hp. for which the Shawinigan company has contracted from the Duke-Price plant. This line will operate at 187 kv., a much higher voltage than is now employed on any system in Canada, although the 220-kv. Ottawa-Toronto line on which construction is about to begin will exceed it. The high-tension neutrals will be solidly grounded throughout the system. The oil circuit breakers will, it is said, be the largest, both electrically and physically, in Canada. Contractors have almost completed installation of transformers and other equipment at the Duke-Price plant, ready to take the load on the new system.

At the Isle Maligne generating station there is being installed a bank of three transformers and one spare. These transformers, to be furnished by the Canadian General Electric Company, are 60-cycle, 25,000-kva. machines. There are seven step-down transformers, four of which are being installed at Quebec City and three at Port Alfred, Que. The Quebec transformers will supply power to the present 60,000-volt system of the Shawinigan Water & Power Company in and around the city. The transformers for Port Alfred will be provided with a 6,600-volt low-voltage winding to supply power for electric-steam boilers.

On the low-tension side of the step-up transformers 15,000-volt, 4,000-amp. oil circuit breakers will be used. They will have an interrupting capacity of 67,000 amp. at 12,000 volts. For the transmission lines ten 187,000-volt oil circuit breakers are being provided. These have an interrupting capacity of 3,800 amp. at 187,000 volts. As they will be installed outdoors in a climate where the temperature is low at certain times of the year, immersion-type heating units will be used. The floor space occupied by the circuit breakers will be 9 ft. x 31 ft., and the height over the bushings will be 20 ft.

The Duke-Price Power Company will soon install the last two generators in its plant at Isle Maligne. The plant now has in operation ten generator units, with a total capacity of 400,000 hp. These units are fairly well loaded at present and will be fully loaded when Shawinigan takes its 100,000 hp. load from the plant. A steady increase during the past year has been due to the operations of Price Brothers, the Aluminum Company and the Port Alfred pulp and paper mills.

Briefer News

Michigan Association Will Meet in July.—The Michigan Electric Light Association will hold its annual convention, in conjunction with the Michigan Gas Association, at the Grand Hotel, Mackinac Island, Mich., on July 5, 6 and 7.

Another Power Company Goes in for Reforestation.—The Niagara, Lockport & Ontario Power Company is setting out 100,000 Scotch pines as a beginning to an extensive reforestation campaign to be carried out in the vicinity of its Salmon River development in northern New York.

Experimental Rural Service in Ohio.—In the last year the Ohio Edison Company has built a line reaching thirteen farms along a route of 5 miles near Marysville to facilitate study and experiment. The work is being carried on by the company in co-operation with the Ohio State Grange, other farm organizations, the Ohio State University and the East Central Division of the National Electric Light Association.

More Power Sought from Roanoke Rapids. — The Virginia Electric & Power Company is seeking to acquire riparian rights at Roanoke Rapids, N. C., which will give it 21,000 hp. in addition to its present power facilities there. Under the plan the power company would take over the riparian rights of the Roanoke Mills and of the Roanoke Fiber Board Company. Acquisition of these rights, it is said, is now being sought.

Quincy (Mass.) Rate Reduced.—By majority vote the Massachusetts Department of Public Utilities has ordered a reduction in the maximum net rate of the Quincy Electric Light & Power Company from 9 to 7½ cents per kilowatt-hour and in the gross maximum from 12 to 8½ cents. Chairman Attwill and Commissioner Wells dissented, believing that the rate should be 8 cents, pending the adoption of a service charge. Since the hearings the company has made a 10 per cent reduction in street-lighting rates.

Pecos Valley Power & Light Company Organization Announced. — Organization of the Pecos Valley Power & Light Company to electrify the oil fields of western Texas has just been announced by G. I. Rhodes of Ford, Bacon & Davis, who will be president. Its plant on the Pecos River will have an ultimate capacity of 12,000 kw. and an 80-mile transmission line.

Reductions in Pasadena Rates.—Reductions in light and power rates of the Light and Power Department of the city of Pasadena, Cal., were made effective by an ordinance which the Board of City Directors adopted on April 28. The new power rate makes a reduction to large, continuous users without penalty for use during the peak period. There is also a reduction for off-peak use. The domestic and commercial lighting rates are to be as follows: For the first 100 kw.-hr. or less per month, 5 cents per kilowatt-hour; for the next 400 kw.-hr., 4.5 cents; for the next 500 kw.-hr., 4 cents; for the next 1,000 kw.-hr., 3.5 cents; for all over 2,000 kw.-hr., 3 cents.

Seattle Plans to Go Ahead with Diablo Canyon Dam.—The Seattle City Council has adopted an ordinance authorizing the employment of the Constant Angle Arch Dam Company of California to draft plans for the Diablo Canyon Dam, which is to permit the installation of another unit of the city's Skagit River hydro-electric project. City officials expect to award contract for the dam, which will cost $3,400,000, by Aug. 1, to start construction by Oct. 1 and to bring the work to completion in the fall of 1928.

A Fifth Unit for Hudson Avenue.—Announcement was made last Saturday by President M. S. Sloan of the Brooklyn Edison Company that a fifth turbo-generator unit has been authorized and will soon be ordered for the company's Hudson Avenue station. This unit will have a rating 25 per cent larger than that of unit No. 4—about 100,000 kw. as compared with 80,000 kw.—and will bring the total installed capacity of the plant to 330,000 kw., with three more units still to come before its ultimate rating is reached. The company's engineers are busy completing the design of the new machine.

Kansas City Power Plant Changes Hands. — In accordance with previous announcement, the power plant of the Kansas City Power Service Company at Second Street and Grand Avenue, Kansas City, Mo., was turned over at midnight May 9 to the Kansas City Power & Light Company for $2,500,000. This plant, which has supplied power for the electric railway system of the city, has at present a capacity of 59,000 kw., but the Kansas City Power & Light announces that it will be enlarged to an eventual capacity of 150,000 kw.

A.S.M.E. Central-Station Session at White Sulphur Springs. — The annual spring meeting of the American Society of Mechanical Engineers will be held on May 23 to 26 at White Sulphur Springs, W. Va. Technical sessions will cover education and power, central-station power, fuels, management, wood industries, hydraulics, machine-shop practice, oil and gas power, railroads, industrial power and materials handling. At the central-station session these three papers will be given: "High-Pressure Steam at Edgar Station," I. E. Moultrop; "High Steam Pressure and Temperature at Crawford Avenue Station," A. D. Bailey; "Strength of Pipe Flanges," E. O. Waters and J. Hall Taylor.

Illuminating Engineers Inspect Street Lighting of Indianapolis.—The Illuminating Engineering Society's Committee on street lighting met in Indianapolis recently and studied the street-lighting system of that city. High praise was accorded to the new

downtown system, though in some other parts of the city the equipment came in for criticism as in need of improvement. General problems of municipal lighting were discussed at length at the day's meetings. A resolution was adopted expressing the view that it is not economical to employ for street lighting lamps of less than 2,500 lumens each. Officials of the Indianapolis Power & Light Company were hosts at a banquet the first evening, after which the visitors were taken on a tour of inspection.

San Jose's New Substation Goes Into Service. — A substation built by the Pacific Gas & Electric Company at San Jose in the fast time of seven months, at a cost of $600,000, has just gone into service. It is a two-story structure of steel and reinforced concrete, designated as Station B, at Fox Avenue and Santa Teresa Street, where it occupies the entire block. Its 30,000-kw. bank of transformers takes power from the Newark distributing station at 100,000 volts and steps it down to 11,000 volts. Part of its output is sent out on rural lines and the rest goes to Station A, the old receiving station, which supplies the city of San Jose. The formal dedication of Station B to "Pacific service" took place on May 2, with a large attendance of citizens.

Electric Service Saves the Day at Beardstown.—Like all the other large rivers in the Mississippi Valley, the Illinois overflowed its banks in this era of flood, and one of the cities that came in for inundation was Beardstown, Ill., a manufacturing place of 7,000 population. Owing to the growth of electrical service, supplied by the Central Illinois Public Service Company, the flood, although the second highest in the history of the river, failed to hamper business to the extent it had done in the past. One of the largest industries of the city, the Schultz-Baujan Flour Company, which had only recently electrified its mill, operated continuously, at full capacity day and night, steel-tower lines conveying uninterrupted service. In former floods the mill had been forced to close down because of inability to keep its boiler pits from being flooded.

Sioux City Considers Municipal Lighting Plant.—Plans for a municipally owned and operated electric light and power plant were recently submitted by Arthur L. Mullergren, a Kansas City consulting engineer, to city officials of Sioux City, Iowa. According to a summary made public, they promise little financial benefit. The engineer's statement dealt with six types of plants. One of these is understood to show a saving of $4,681 annually and another type a saving of $2,028. The remaining four show a net loss. The plans recommended by Mr. Mullergren would cost $292,250 and consist of two 400-kw. Diesel engines that would produce power and light for the city electrolier system, the city buildings and the Main Street pumping station. The annual cost of operating such a plant would be $101,949 as compared to the present cost of $106,630 for the same service. The city now obtains its power for operating the street lights and electroliers from the Sioux City Gas & Electric Company. The street lighting costs the city $44,965 annually and the cost of electricity for the electroliers is $18,972.

Negotiations Over Ottawa River Power in Early Prospect.—It has now been officially announced that the Canadian government will endeavor to initiate negotiations with the governments of Ontario and Quebec looking to a settlement of the vexed question of the Ottawa River water powers. The way is cleared by the refusal of Parliament to renew the charter of the Georgian Bay Canal Company and by the fact that conditions under which the National Hydro-Electric Company secured 300,000 hp. at Carillon have not been fulfilled and the government has so far refused to renew the company's lease, which expired on May 1. The Dominion government takes the position that while the Provinces of Ontario and Quebec have rights on the Ottawa River, the Dominion has full authority over navigation and particularly over the power developed from Dominion undertakings. As matters now stand, the federal government and the two provinces all claim the powers in question and none shows any disposition to yield.

Coming Meetings of Electrical and Allied Societies

American Society of Mechanical Engineers—White Sulphur Springs, W. Va., May 23-26. C. W. Rice, 29 West 39th St., New York.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

American Institute of Electrical Engineers—Northeast District, Pittsfield, Mass., May 25-27; summer convention, Detroit, June 20-24. F. L. Hutchinson, 36 West 39th St., New York.

Arizona Utilities Association—Monte Vista Hotel, Flagstaff, May 26-27. Ben Ferguson, Central Arizona Light & Power Co., Phoenix, Ariz.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., May 28-June 4. S. N. Clarkson, 420 Lexington Ave., N. Y. C.

American Association of Engineers—Tulsa, Okla., June 6-8. M. E. McIver, 63 East Adams St., Chicago.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Exposition, Syria Mosque, Pittsburgh, June 13-18. J. F. Kelly, Empire Building, Pittsburgh.

Pacific Coast Electrical Association—Santa Cruz, Cal., June 14-18. S. H. Taylor, 447 Sutter St., San Francisco.

National Electrical Credit Association—Cleveland Hotel, Cleveland, June 16-17. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Society for Testing Materials—French Lick, Ind., June 20-24. C. L. Warwick, 1315 Spruce St., Philadelphia.

Empire State Gas and Electric Association, Commercial Section—Elmira, N. Y., June 21-22. C. H. B. Chapin, Grand Central Terminal, New York.

Northwest Electric Light and Power Association—Salt Lake City, June 21-24. C. W. Lundquist, Utah Power & Light Co., Salt Lake City.

American Society of Agricultural Engineers—University Farm, St. Paul, Minn., June 22 to 25. Raymond Olney, St. Joseph, Mich.

North Central Division, N.E.L.A.—Lake Superior steamboats from Duluth, June 24-28. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Michigan Electric Light Association—Grand Hotel, Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

East Central Division, N.E.L.A.—Cedar Point, Ohio,, July 12-15. D. L. Gaskill, Greenville, Ohio.

American Society of Agricultural Engineers to Have Electrification Program.—Provision has been made in the program of the American Society of Agricultural Engineers, whose annual meeting will be held in St. Paul on June 22-25, for a rural electrification program, which will include papers on rural electrification in Europe, some phases of the rate question, rural refrigeration, automatic feed grinding and the activities of the public utility interests in advancing the use of electricity in agriculture. This session will be held on the opening day and will include committee reports, discussions of plans for the coming year and the presentation of technical papers.

Welding Society Announces Establishment of Medal.—At the annual dinner of the American Welding Society held in New York on April 28, President F. M. Farmer announced the donation of an award, the gift of Samuel Wylie Miller, to be presented by the society annually in appreciation of work of outstanding merit in advancing the art and science of welding. The award is a gold medal, which will be known as the Miller medal. Mr. Miller, who is consulting engineer with the Union Carbide & Carbon Research Laboratories, Inc., has been one of the outstanding figures in the advancement of welding ever since its commercial inception. He is a past-president of the American Welding Society and a prominent and active member of the American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers and other scientific and engineering organizations.

Utah Electrical Men Gather at Salt Lake City.—The sixth annual convention of representatives of the various branches of the electrical industry in Salt Lake City and nearby territory, voted the best yet held, assembled on April 25 in that city, with the Electrical League of Utah acting as sponsor. Its vice-president, R. M. Bleak, presided. Addresses were made by B. E. Rowley, Salt Lake manager of the Edison Electric Appliance Company; R. E. Folland, field secretary of the league; Fred. D. Winegar, city electrical inspector; W. H. Folland, city attorney; S. H. Babcock, Jr., of the Westinghouse company; J. A. Kahn, president Capital Electric Company; George P. Trayner, Utah Power & Light Company, and F. C. Wolters, manager Modern Electric Company—the four last named speaking respectively for the manufacturers, the jobbers, the central station and the contractors. P. M. Parry, commercial manager Utah Power & Light Company, was toastmaster at the banquet.

Men of the Industry

H. H. Jones to Leave California

H. H. Jones, vice-president and general manager of the Western States Gas & Electric Company at Stockton, Cal., will be transferred to the general offices of H. M. Byllesby & Company at Chicago, when the deal conveying the

H. H. JONES

Western States company to the Pacific Gas & Electric Company is consummated. Mr. Jones removed to Stockton two years ago when Samuel Kahn was transferred to the general managership of the Market Street Railways Company in San Francisco. He spent fourteen years as president and general manager of the San Diego Consolidated Gas & Electric Company at San Diego, Cal., also a Byllesby property. After leaving the San Diego post he was for eighteen months vice-president in charge of operations of the Northern States Power Company, following which he was transferred to Stockton.

Mr. Jones was born in Reading, Pa., and was graduated from Lehigh University. Through his early connections in the public utility field he gained a knowledge of both steam and electric railways as well as construction work. It was in 1909 that he first affiliated himself with H. M. Byllesby & Company as manager of the Sandpoint division of the Northern Idaho & Montana Power Company, now the Mountain States Power Company.

W. C. L. Eglin, vice-president and chief engineer of the Philadelphia Electric Company, has been elected a member of the board of directors of that company.

F. M. Farmer, chief engineer of the Electrical Testing Laboratories, New York, and a past-president of the American Society for Testing Materials, has been re-elected president of the American Welding Society.

J. F. Fogarty, a vice-president of the North American Company, has been elected a member of the executive committee, and **J. B. Black** and **H. C. Freeman** were elected vice-presidents. Mr. Black had for some time been vice-president and general manager of the Great Western Power Company and recently removed to New York as vice-president of the Western Power Corporation, the North America's subsidiary which controls the Great Western Power, the San Joaquin Light & Power and the Midland Counties Public Service. Mr. Freeman is, perhaps, best known in the field of public accountancy.

Paul A. Schoellkopf, president of the Buffalo, Niagara & Eastern Power Corporation, Buffalo, returned to the United States aboard the Cunard liner *Berengaria* May 13. Mr. Schoellkopf had been abroad for about ten weeks.

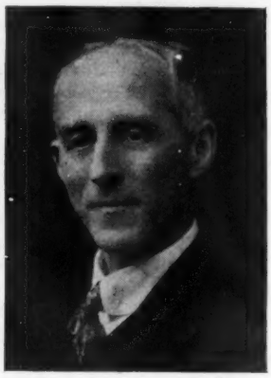
E. R. Dickerson, for the past three years district superintendent of the West Penn Power Company at Uniontown, Pa., has resigned.

Horatio G. Floyd, a member of the banking house of Drexel & Company, has been chosen chairman of the executive committee of the Philadelphia Electric Company. This is a newly created body, and the other members are: Walter H. Johnson, president of the company; Charles E. Ingersoll, president of the Central National Bank and a director of the Pennsylvania Railroad, and John T. Windrim, architect.

A. F. Traver, formerly connected with the organization of Henry L. Doherty & Company, has joined the Associated Gas & Electric System as operating manager with headquarters at Columbus, Ohio. Mr. Traver is a graduate of the University of Michigan. He has been affiliated with the Chattanooga Gas Company, the Denver Gas & Electric Company and the Improved Equipment Company, of which he was vice-president. Mr. Traver has acted as consulting engineer for investment bankers and operators in the examination and operation of electric and gas properties.

R. V. Bingay Becomes Director of Allis-Chalmers Company

R. V. Bingay, president of the Pittsburgh Transformer Company and an outstanding figure in the transformer field, has been made a director of the Allis-Chalmers Manufacturing Company of Milwaukee following the acquisition of the Pittsburgh company by the Allis-Chalmers organization. Mr. Bingay will remain as president of the Pittsburgh Transformer Company,



R. V. BINGAY

which will continue the manufacture and sale of its various lines.

Mr. Bingay affiliated himself with the Pittsburgh Transformer Company as manager two years after its founding in 1898. All of his early training had been in the electrical business. At seventeen he was helping to build dynamos and motors in the plant of the Royal Electric Company in Canada. Since he removed his interests to Pittsburgh he has introduced improvements rapidly. His broad human sympathies are demonstrated daily in the factory and in the cordial relations that exist between him and the neighborhood in which the factory is located. He is a member of the A.I.E.E. and of other technical societies.

Obituary

Lester L. Shivers, president of the Carter Electric Company, General Electric Company distributor for Georgia, died in Atlanta May 9 following an operation at the Wesley Memorial Hospital. Mr. Shivers joined the Carter Electric Company seventeen years ago as salesman and soon after was made vice-president and general manager. In 1922 he bought the controlling interest in the company and became president, in which capacity he remained until his death, though earlier in this year the General Electric Company took over the control of the Carter Electric Company. Mr. Shivers was 51 years of age.

Einar A. Johnsen, chief mechanical engineer of the American Gas & Electric Company, died at the Post-Graduate Hospital, New York, May 13, from pneumonia following an operation. Mr. Johnsen was born at Oslo, Norway, 49 years ago and was graduated from Christiania Engineering College in 1902. He soon became an outstanding figure in the field of mechanical engineering. In 1915 he joined the American Gas & Electric Company, and he represented this company in the design and construction of the Beech Bottom power station at Windsor, W. Va. Following the construction of the Windsor plant came those at Philo, Ohio, in 1920; Twin Branch, Ind., in 1922, and Stanton, Pa., in 1925. His last work was as representative of the American Gas & Electric Company in designing the enlargement of the Philo station.

Paul Smith, Jr., son of Paul Smith, Adirondack pioneer, died May 14 at Big Rock, Va., from blood poisoning caused by an ulcerated tooth. Mr. Smith was associated with his father and brother in developing the Paul Smith Electric Light & Power Company, which serves Lake Placid, Saranac and the surrounding region, as part of a large enterprise involving 30,000 acres of Adirondack property and a hotel, camps and cottages. He was born at Paul Smith's, N. Y., and attended the Peekskill Military Academy.

Recent Court Decisions

Company Damming Stream Cannot Ignore Regulations of State Board of Health Made After Work Began.—In Wheeler vs. River Falls Power Company the Supreme Court of Alabama held that an allegation that the defendant company in erecting a dam failed to abolish mosquito-breeding conditions stated a cause of action for nuisance. Such a company cannot proceed to build the dam without reference to the regulations of the State Board of Health, even though construction was begun prior to the enactment of the regulations, if no waters had been impounded until after the rules were adopted. On rehearing, the court said that a complaint containing no allegation that the dam was wrongfully or unlawfully erected did not state cause of action as against nuisance, since a dam is not a nuisance *per se*—that is, at all times and under all circumstances. (111 So. 907.)*

Commission Justified in Refusing Second Valuation in Year.—The Virginia Supreme Court of Appeals holds that the State Corporation Commission made no error in refusing the motion of the Virginia Railway & Power Company for a revaluation of its property where the property had been appraised by the commission only a year before (Dyer vs. Virginia Railway & Power Company). The court said: "That the commission had the authority to make such appraisal is conceded. . . . . That it judicially exercised discretion in this case is apparent. The reasons therefor, as expressed in the opinion overruling the motion, are convincing. The property so used in the public service had been appraised by the commission for rate-making purposes about one year theretofore and there had been no substantial additions to the property or changes in such valuation in the interval. . . . Under these circumstances, it would have been an improper use of the public funds to make such an unnecessary expenditure for the appraisement of this property."

Why Maryland Courts Cannot Bar Out Competing Company.—In refusing an injunction to the Northern Maryland Power Company against the Consolidated Gas, Electric Light & Power Company barring the latter from serving Havre de Grace (see ELECTRICAL WORLD for May 7, page 974) Circuit Court No. 2 of Baltimore said it was contended that if the Consolidated Gas company were to enter Havre de Grace, it would be destructive of invested capital in the Northern Maryland company and disturb service and rates to an extent which must eventually react to damage and loss of the public in that community. The remedy, the court indicated, lay in the Legislature, not the courts. "The defendant company," it said, "contends that notwithstanding its past custom of submitting plans for extension to the Public Service Commission, it was more by grace than in recognition of any legal duty or obligation so to do, and that it is not required by law to ask for permission from or the approval of the Public Service Commission, because its franchise is state-wide; that it can carry its lines and service to any point in the state where it finds a demand without asking for the approval of the Public Service Commission; that the limitation on construction in Section 33 contemplates only the initial work in exercise of a franchise and does not cover renewal or extension of its plant or equipment, irrespective of the territory it might invade, whether through counties, towns or cities, except in so far as the public service law is regulatory in the enforcement and operation of the police powers of the state." The court held this agreement valid, saying: "There is nothing in Section 33, as it now stands, dealing with the extension of lines or service. And the question arises, do the provisions of Section 33 give to the Public Service Commission the power to limit or control the right of the Consolidated Gas company to erect poles, wires and equipment to extend its lines and systems under the exercise of its franchise? The answer is in the negative."

Possibility of Weak-Hearted Person Being Killed by 110 Volts Immaterial Where Victim Had Strong Heart.—The Court of Appeals of Georgia has affirmed an award of damages in Crosby vs. Mutual Light & Water Company, where it was contended that the operator of an electric milk shaker had been killed by an excessive voltage allowed to pass over a secondary wire supposed to carry 110 to 120 volts. The defendant, refusing to admit responsibility, presented evidence to show that a person not physically strong and with a weak heart might be killed by voltage of such low value if he were standing on a wet floor. The court said this testimony had no pertinence since it had been shown that the victim was a strong young man with a strong heart. (137 S.E. 639.)

Western Carolina Power Company Fails to Place on Contractor Blame for Failure to Complete Plant.—The Hardaway Contracting Company of Columbus, Ga., has received an award of approximately $500,000 in two suits involving the contracting company and the Western Carolina Power Company and growing out of the failure to complete the Bridgewater hydro-electric power development on the Catawba River. The case first came into the courts in 1919, when the Columbus concern filed suit for $1,395,970 against the power company, which filed a cross-bill seeking penalties from the Hardaway company for failure to complete the dam. Work was stopped in March, 1919, in protest against impounding an estimated six billion gallons of water above the uncompleted dam. It was claimed that this threatened to break the dam and to cause a disastrous flood. The referee found that the contracting company was not chargeable with the delays.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Preference Given to Employees and Consumers in Stock Ownership.—The desirability of stock ownership by the employees and patrons of public utilities has been recognized by an order of the Public Utilities Commission of the District of Columbia affecting the Potomac Electric Power Company and decreeing that preference be given to employees and consumers in the allotment of preferred stock to subscribers.

No Discrimination in Rates to Stockholders.—The recurrent question of discrimination in favor of stockholders has again arisen in a decision of the Michigan Public Utilities Commission that it would be an unlawful discrimination for the Winn Telephone Company to set up a rate for stockholders lower than a rate for non-stockholders. The commission decreed that if the stockholders desire dividends they should divide the surplus of the company at the end of the year after all operating and maintenance expenses have been paid and a certain percentage set aside for depreciation.

Public Interest Served by Permitting Amalgamation of Two Companies Controlled by Same Interests.—In granting to the New York State Gas & Electric Corporation permission to acquire by donation the outstanding capital stock of the Staten Island Edison Corporation, the New York Public Service Commission, premising that these companies are both controlled by the American Gas & Electric Company, said: "It has been shown that, in addition to the motive of securing a better financing agency for the Staten Island Edison Corporation, a close relation has already been established whereby the latter company will be furnished with necessary power through the transmission lines of the New York State Gas & Electric Corporation and intercommunication with the Public Service Corporation of New Jersey. The present facilities of the Staten Island Company, with the additions now being made, will inside of six years be outgrown. It is necessary, therefore, to provide for the future, and this, it is believed, can be done more economically through energy furnished through connections to be established than by the considerable expenditure required for an adequate addition to the present plant. The Staten Island company and the Public Service Corporation of New Jersey are already connected by submarine cable and exchange power. It is believed that the present facilities of the New York State Gas & Electric Corporation and the extensions it is contemplating, with those already under way, in addition to the contractual engagements it has with other companies, will enable it to serve the Staten Island Edison Corporation, so that this last-mentioned concern will be in a satisfactory position to meet the expected demands of the future. It would appear that the public interest will be served by granting petition."

Financial and Statistical

Market Again Moves Upward

Curb Issues Active

Bond Averages Stay Unchanged

COMMON stocks of electric light and power companies during the week ended May 18 continued to show improvement, and many advances were recorded in this class of security. Laclede Gas Light stock, which previously this year had gone from a low of 173¾ to a high of 235, went to a further high of 241½ following the announcement of the acquisition of the company by the Utilities Power & Light Corporation. Notable records were made by the Public Service Corporation of New Jersey, which advanced seven points during the week under review, and by the Pacific Gas & Electric Company, which showed an increase of six points. Also among the gainers were the Detroit Edison, Commonwealth Edison and Boston Edison.

Public utility stocks were prominent in curb activities. American Gas & Electric, Buffalo, Niagara & Eastern Power, American Light & Traction and Southeastern Power & Light all showed advances.

Some gains were made by the preferred issues, but there were no outstanding features to effect an important net change. Not much change took place in the bond market during the week, averages remaining about the same. The ELECTRICAL WORLD index number of power and light bonds remains at 103, the same figure recorded for last week.

Central Light and Power Plants in Western Hemisphere

A compilation which should be of considerable interest to manufacturers engaged in the export trade has recently been published by the Bureau of Foreign and Domestic Commerce of the Department of Commerce. It was prepared by Howard E. Way of the Electrical Export Division and is designated as "Trade Information Bulletin No. 469." In addition to statistical data, it gives pertinent notes on the type of populations in the various countries discussed, the kind of domestic help available, the type of electric service, the kinds of domestic appliances for which there are commercial possibilities, the sources from which most of the electrical imports are derived, the degree of supervision over installations and appliances exercised by regulatory bodies, and other useful information.

Beginning with Canada, the various countries are taken up individually. Mexico, the various island groups of the British West Indies and the remainder of the West Indies follow the Dominion. The Central American countries and those of South America are then taken up one by one.

A particularly useful form of information for reference purposes is to be found in the compilation, by countries, of cities having electric service, with designation of the type of current, voltage for lighting, voltage for small power, and kilowatt capacity of plants. Thus, in nearly 300 cities listed in Argentina, by far the majority have a 220-volt direct-current service for residential purposes. Evidently the three-wire system prevails, for the small power circuits are predominantly at 440 volts. Brazil appears to be almost equally divided between direct and alternating current, the latter usually at 50 cycles. The country's largest generating system has 40,000 kw. capacity; only two others in the list exceed 10,000 kw. In Chile, with 44 cities listed, the 220-440-volt, three-wire direct-current system strongly predominates. The three largest installations are of 66,000, 30,000 and 10,000 kw. capacity.

Cost of Marketing Issues Varies Widely

Size of Banker's Commission Depends on Difficulty of Selling Issue and on Other Factors Corresponding to Distribution Cost of Any Other Commodity

REFERRING to the cost of raising new capital to finance the public utility industry, F. B. H. Paine, in a recently issued publication called "Public Utility Financing," says:

"During the past two years I have been under the necessity and have had the opportunity and facilities of informing myself as to the cost of acquiring money in the case of sixteen large and well-known utility companies with nineteen issues of the highest-grade bonds, rated in Moody's 'Analysis of Public Utilities' as AA or A and marketed within a period from 1908 to 1914. The result of my investigation was to find that the cost incident to the disposition of the senior highest-grade securities of these large well-known securities was 5 per cent; discounts were much more than that. The cost incident to selling bonds rated by Moody's as BA and BAA, found in the same manner, was 7.9 per cent."

These figures are supported by data presented by members of the investment banking group and suggest a brief study of the factors entering into the cost of raising new capital. The discount factor, which also enters into costs, will be dealt with separately.

Apart from the relatively small volume of financing carried on through the sale of stock direct to customers and the issue of rights to shareholders, money must be secured through the agency of a banking or underwriting house. A banker is obliged first of all to make a thorough investigation of the property from an engineering, commercial and legal point of view. When he decides to underwrite an issue he assumes the risk of changes in the financial situation, or of a possible error in judgment as to the salability of the securities and the price that they will command. Sometimes a banker is obliged to carry issued securities for a considerable period. The public requires immediate service, and the banker, therefore, must advance the funds to the utility for construction or other purposes. Naturally, the banker must retain a sufficiently large organization to reach a wide market. His overhead cost, as well as the expense involved in making a preliminary investigation, and later in marketing the securities, must be taken into account, as well as the actual detail costs in connection with an issue.

QUALITY OF ISSUE IMPORTANT

When these costs which apply to all issues have been considered, there is also the question of the standing of the company and the particular issue concerned. Naturally, the cost of securing capital will be greater in the case of junior financing than of senior financing. It will be greater in the case of relatively small issues, or issues of concerns not favorably situated, than with larger issues and those of older companies. It is naturally less difficult to market the securities of a company of high standing which has sold its issues favorably for a long period of years. In the cost of individual financing the rate on invested capital will largely determine the market value of outstanding securities. It cannot be expected that new issues of any company will sell at a better rate than similar existing issues of the same company. The current market quotation for existing securities is the market's appraisal of the risk incurred in connection with proposed issues. If that risk is great, as measured by market price, it is evident that the risk on new securities offered will be similar.

Furthermore, government regulation must be taken into account in the case of public utilities, while industrial and other companies are subject only to the natural economic laws of supply and demand. Utilities are limited in the amount they can earn, regardless of the supply of and demand for their product. While many industrial companies are able to meet increased labor and material costs by passing these on to the consumer in increased prices, utilities have their rates fixed so that increased costs have to be reflected in decreased earnings. Utility earnings, moreover, have often been less than those expected in other industries. Then there is always more or less apprehen-

sion in the public mind that regulation may at some future time fix a rigid rate of earnings to investors.

For the reasons stated, it is evident that generalization cannot be made with regard to the cost of raising new capital. Such costs vary so widely that an average would be meaningless. The range is probably from zero to 12 or more points gross, but no two issues would be governed by the same factors in the determination of brokerage commission.

Considerable attention has been paid recently to the cost of selling stock direct to customers. Naturally, it is now possible to sell stock to customers more easily than when customer ownership was new. According to an investigation carried on by the National Electric Light Association, the selling cost per share in the case of 84 companies studied ran as high as $9 in one instance, but the average for 35 companies was only $4.30. Investigation shows that the cost in many cases is even lower than this at the present time. One large company was able to reduce its selling costs almost a dollar a share during the past year, and in the case of two large and very successful companies the cost has been reduced to 94 cents and 70 cents respectively per share. These figures include advertising expenses and commissions to salesmen.

A number of companies have recently cut down the commissions paid to employees for selling stock to customers, and it is probable, judging from statements made by some of the companies, that the average cost is now only marginal in the case of the larger and better-known companies whose public relations are on a satisfactory basis.

Electrical Development in Russia

The fiscal year 1925-26 witnessed the inauguration of the following five new power stations of large capacity in Soviet Russia, according to a recent issue of the *Soviet Union Review:*

	Kw.
Shatura	32,000
Shterov	20,000
Nizhni-Novgorod	20,000
Tashkent	2,200
Erivan	2,000

Power stations approaching completion or starting operation during the first three months of the new fiscal year were:

	Kw.
Volkhov*	56,000
Zemo-Avchal (Caucasus)	13,000
Sverdlovsk (formerly Ekaterinburg) (Ural)	6,000
Lyapinsk (Yaroslav)	5,000

*Opened Nov. 16, 1926.

In addition, other new stations and extensions to existing plants with a combined supplementary capacity of 305,500 kw. were erected during the past year.

According to preliminary data, the electrical energy output of all public utility plants aggregated about 1,500,000,000 kw.-hr. for the fiscal year 1925-26, as against 690,000,000 kw.-hr. for 1913, while the chief electric power plants supplying individual factories and mills produced 1,400,000,000 kw.-hr., as compared with 1,250,000,000 kw.-hr. in 1913.

Statistics are also given on the basic power equipment in industry, as follows:

	Number of Units	Total Horsepower
Steam engines	24,300	2,773,400
Internal-combustion engines and water turbines	21,200	927,400
Other small mechanical engines	191,900	952,700
Total	237,400	4,653,500

The 50,000 steam boilers in the country have a heating surface of about 3,500,000 sq.m. (37,000,000 sq.ft.). Most of the engines and boilers were installed before the revolution, and renewals on a large scale will be necessary in the near future. The cost of replacements needed within the next five years is estimated at $275,000,000, of which immediate requirements amount to $172,000,000.

Complete population data are not yet available, but the estimated total is about 143,500,000, an increase of 38 per cent over the population of the same territory in 1897 (104,000,000), when the last general census was taken. The urban population is about 25,300,000.

Stock Increases

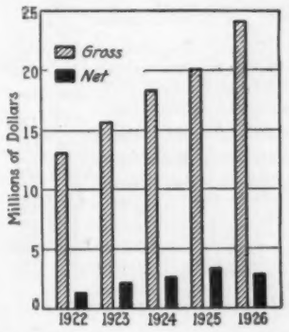
Stockholders of the American & Foreign Power Company, Inc., on May 2 increased the common stock from 1,800,000 shares to 8,300,000 shares and the second preferred stock, series A, from 120,000 shares to 1,600,000 shares and created an authorized issue of 200,000 shares of six-dollar preferred stock, all no par value.

On May 18 stockholders of the American Superpower Corporation met to vote on increasing the authorized first preferred stock (no par value) from 100,000 shares to 200,000 shares, and the class B common stock (no par value) from 750,000 shares to 1,500,000 shares. The present authorized issues of 300,000 shares of participating preferred (par $25) and 600,000 shares of class A common stock (no par value), will remain unchanged. It is stated that all or part of the first preferred stock might be offered publicly soon, but no plans for the issuance of the new common stock have been made.

Marked Progress Shown in Simplifying General Gas & Electric Group

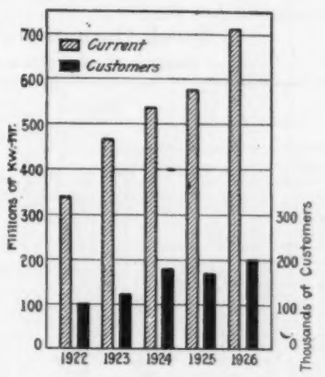
A record year from the standpoint of revenue and the carrying out to a large degree of an extensive simplification policy, as discussed in detail in the issue of the ELECTRICAL WORLD for Dec. 4, 1926, are the two outstanding features of the General Gas & Electric Corporation's annual report, recently issued. Further property units of strategic value have been added.

The changes recently made in the capital structure of subsidiaries of this company are directed to facilitating economic financing in the future. Following a readjustment of Metropolitan Edison preferred stocks whereby a six-dollar cumulative stock is now the vehicle of preferred stock financing, a similar plan was carried out by the Binghamton Light, Heat & Power Company and the New Jersey Power & Light Company. The Metropolitan Edison's financial structure was simplified by merger with the Metropolitan Power and the York Haven Water & Power companies, both subsidiaries. Also, the New Jersey Power & Light Company merged with it the Newton Gas and the Washington Gas companies. These changes have effected a material reduction in overhead costs.



GROSS REVENUE OF GENERAL GAS & ELECTRIC SHOWS CONSISTENT GROWTH

A 15.4 per cent rise in gross revenue and a 25 per cent increase in operating income or net revenue were made possible by a large expansion in the volume of business done. Sales of electricity increased by 23.6 per cent to 712,649,431 kw.-hr. Other branches of business showed a corresponding increase.



ELECTRICAL SALES INCREASE 23.6 PER CENT IN 1926

During the year several operating units in Pennsylvania and adjoining territory now served by the company were purchased. Steps have been taken to merge these with the larger operating companies.

New Capital Issues

During the week ended May 19 the Suburban Light & Power Company of Ohio issued first mortgage collateral 5½ per cent gold bonds, series A, to the amount of $2,500,000, the price being 96 and accrued interest to yield over 5.80 per cent. The company also offered 7 per cent cumulative first preferred stock totaling $500,000, at 95 and dividend, to yield over 7.35 per cent. Proceeds from the sale of these bonds, together with the proceeds from the sale of the stock, will be used for the

retirement of $1,000,000 first mortgage bond-secured 6 per cent gold notes of the company, for the acquisition of new properties, improvements and for other corporate purposes.

An additional issue of series B 6 per cent secured gold notes was offered by the Galveston-Houston Electric Company to the amount of $1,200,000 at a price of 97.41 and interest, to yield about 6.75 per cent.

The United Public Service Company issued 12,000 shares of $7 dividend series preferred stock without par value at $100 per share and accrued dividend. This stock will be issued in exchange for the capital stock of the subsidiaries to be acquired by the company and for working capital.

The Montana Power Company made an offering of 5 per cent gold debentures, series A, to the amount of $12,500,000, the price being 97¼ and accrued interest, yielding over 5.15 per cent. These debentures were dated June 1, 1927, and mature June 1, 1962. Proceeds of this issue are to be applied to the retirement of the company's entire outstanding issue of 7 per cent cumulative preferred stock, to be called for redemption at 120 and accrued dividend on July 1, 1927.

Twenty-year 5½ per cent gold debentures of the Power Corporation of New York were offered to the amount of $5,000,000, the price being 100 and interest. These debentures, dated May 1, 1927 and maturing May 1, 1947, are a direct obligation of the company.

The Pecos Valley Power & Light Company issued first mortgage ten-year 6½ per cent gold bonds, series A, totaling $1,750,000, at 99 and accrued interest, to yield over 6.60 per cent. The bonds are accompanied by stock-option warrants.

Recent Listings. — The governing board of the New York Stock Exchange has authorized the following securities for listing:

Commonwealth Power Corporation common stock totaling 1,239,786 shares without par or face value, with authority to add 5,960 shares of common stock to be issued in exchange for stock of subsidiaries and 119,730 shares of common to be issued for subscription warrants, making a total authorization of 1,365,476 shares.

Brooklyn Edison Company, $15,000,000 capital stock, making the total amount listed $90,000,000.

North American Edison Company, $25,000,000 temporary 5 per cent debentures, series A, due March 1, 1957.

Oklahoma Utility Elects Directors.— At the annual meeting of the Public Service Company of Oklahoma the board of directors was increased to seven members by the election of J. A. Whitlow, manager of the company, and Earl R. Ernsberger, president of the Southwestern Light & Power Company.

Canadian Energy in February 10 per Cent Over 1925

The amount of electrical energy generated in Canada for Canadian use during February, 1927, exceeded that generated during the same month of 1925 by 10 per cent, according to a report by the Royal Bank of Canada. In Ontario and Quebec the excess amounted to 13 per cent. The average number of kilowatt-hours generated daily during December, January and February, as compared with the corresponding figures for the previous year, is given below:

Average number kilowatt-hours generated daily throughout Canada for Canadian use:

	1926-27	1925-26
December	31,381,000	26,573,000
January	31,621,000	27,676,000
February	31,941,000	28,880,000

Average number kilowatt-hours generated daily in Ontario and Quebec for Canadian use:

	1926-27	1925-26
December	25,082,000	20,883,000
January	25,829,000	21,994,000
February	26,129,000	23,156,000

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday May 17	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	k 90	83	94
Adirondack Pwr. & Lt.—7% pf.	110	107	110½
Adirondack Pwr. & Lt.—8% pf.	114	112	114
Ala. Pwr., 7% pf.	112	107	112½
Allis-Chalmers Mfg., 7% pf.	110½	109	112½
Allis-Chalmers Mfg., 6% com.	108½	88	110½
Aluminum Co. of Amer., com.	65	....	....
Aluminum Co. of Amer., 6% of.	103½	101½	101½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	97½	86½	99
Amer. & Foreign Pwr., com.—no par.	22½	18½	25½
Amer. Bosch Magneto, com.—no par	14½	13	18½
Amer. Brown Boveri Elec†.	23½	20½	39½
Amer. Brown Boveri Elec., pf. $7.	k 82	84½	98
Amer. Gas & Elec., 6% pf.—no par.	100½	95½	101½
Amer. Gas & Elec., com.†—no par.	86½	68½	100½
Amer. Lt. & Trac., 6% pf.	115	112	120
Amer. Lt. & Trac., com.†	246	222	262
Amer. Pwr. & Lt., 6% pf.	102	97½	103½
Amer. Pwr. & Lt., com.†—no par.	60½	54	64½
Amer. Pub. Serv., 7% pf.	k101	95	99½
Amer. Pub. Serv., com.†	50	....	....
Amer. Pub. Utilities, 7% ptc. pf.	87½	73	88
Amer. Pub. Utilities, 7% pr. pf.	k 92	88	93
Amer. Pub. Utilities, com.	k 57	65	70
Amer. States Sec., A	3	2½	4½
Amer. States Sec., B	3	2½	4½
Amer. Superpwr., 7% ptc. pf.—25.	28	26½	28½
Amer. Superpwr., 6% 1st pf.	l 96½	....	....
Amer. Superpwr., Class A†—no par.	35	27½	35½
Amer. Superpwr., Class B†—no par.	35½	28½	36½
Amer. Wtr. Wks. & Elec., 7% pf.	109½	105	110½
Amer. W. W. & E., com. $1.60—20.	80½	62½	83½
Anaconda Copper 2d $3	46	45	49½
Appalachian Electric Pwr., 7% 1st pf.	102	100	104
Appalachian Elec. Pwr., 2d pf., 7%.	100	100	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	84	77	84½
Arizona Pwr., com.	22	....	....
Arkansas Pwr., & Lt. 7% pf.	103½	....	....
Assoc. Gas & Elec., $3.50—50.	52	....	....
Assoc Gas & Elec., pf.—$6—no par.	91	85	93
Assoc. G. & E., Class A, $2.50—no par	m 40½	35	42
BABCOCK & WILCOX, 7% com.	118	....	....
Binghamton L., H. & P., $6 pf.	96	93	98
Birmingham Elec., pf.—$7—no par.	108	105	109
Blackstone Valley G. & E., 6% pf.	103	103	105
Blackstone Valley Gas & Elec., 10% com.—50	143½	98	154½
Blaw-Knox, com.†	c 70	70	70
Brazilian Trac., Lt. & pwr., com.†	f138½	....	....
Broad River Pwr., 7% pf.	101	97	100
Brooklyn Edison, 8% com.	154½	148½	169½
Buffalo, Niagara & East. Pwr., pf.—25	l 25½	....	....
Buffalo, Niagara & East. Pwr. com.† —no par.	l 29	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	96½	96	98
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f109	107	108½
Central & S. W. Util., 7% pf.—no par	a 96	93½	97½
Central & S. W. Util., pr. ln. $7 pf. —no par	a100½	98½	103
Central Ariz. Lt. & Pwr., 7% pf.	f100	100	100
Central Ark. Ry. & Lt., 7% pf.	103	100	104

Companies	Bid Price Tuesday May 17	Low 1927	High 1927
Central Ill. Pub. Serv., 6% pf.	k 88	88	91
Central Ind. Pwr., 7% pf.	k 89	86	90
Central Pwr. & Lt., 7% pf.	k101	100½	103
Central States Elec., 7% pf.	96	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par.	m 33½	30	34½
Cincinnati Gas & Elec., 5% com.	g 97	93½	97½
Cities Service, 6% pf. ex. div.	k 91½	87	92½
Cities Service, pf. B—10 ex. div.	k 8½	7½	8½
Cities Service, pf. BB—100.	k 83	81	85½
Cities Service, com.—20 ex. div.	k 47	40½	58½
Cities Service, Bks. Shrs.—10.	k 23½	23½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	111	108	110
Cleveland Elec. Illg., 10% com.	298	302	310
Colorado Pwr., 7% pf.	k 95	95	97½
Columbia Gas & Elec., 6% pf.	107	99½	107½
Columbia G. & E. com. $5—no par.	92½	82½	96½
Columbia Ry., Gas & Elec., 6% pf.	m 94	....	....
Columbus Elec. & Pwr., 7% pf., A.	108	....	....
Columbus Elec. & Pwr., $2 com.—no par	64½	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102	98½	99½
Columbus Ry., Pwr. & Lt., 6½% pf. B	101½	96	99
Columbus Ry., P. & L., com.—no par	70	75	79
Commonwealth Edison, 8% com.	c150½	138	147
Commonwealth Pwr., 6% pf.	97½	91½	97½
Commonw'th Pwr., $2, com.—no par	51½	49½	52
Conn. Lt. & Pwr., 8% pf.	120	119	123
Conn. Lt. & Pwr., 7% pf.	116	112	113½
Cons. Gas of N. Y., pf.†—50.	k 56½	55½	62½
Cons. Gas of N. Y., com $5—no par.	103½	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	k108	106½	108
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112	110½	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	k110	111	115
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e128½	126	129
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	e 57½	51	57
Consolidated Pwr. & Lt., 7% pf.	101	100	103
Consumers Pwr., 6% pf.	102½	100	102
Consumers Pwr., 6.6% pf.	105½	103	105½
Continental Gas & Elec., 8% pte. pf.	106	103	106½
Continental Gas & Elec., 7% pr. pf.	103	100	103
Conti. G. & E. com. $4.40—no par.	k215	210	225
Crocker Wheeler, com.†	31	....	....
Crocker Wheeler, 7% pf.	81	....	....
DALLAS PWR. & LT., 7% pf.	108	107	109½
Dayton Pwr. & Lt., 6% pf.	103	101	103
Detroit Edison, 8% com.	146½	133½	148
Dubilier Condenser, com.—no par.	4½	3½	5½
Duquesne Lt., 7% pf.	k116	114	117
EASTERN NEW YORK UTIL., $7 pf.	104	102	104½
Eastern New York Util. com.	102	70	75
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	87	90	95
East. Tex. Elec., 7% pf.	106	106	108
Edison Elec. of Boston, $12 com.	d255	217	259

Companies	Bid Price Tuesday May 17	Low 1927	High 1927
El Paso Elec., 7% pf.	107	105	107½
Elec. Bond & Share, 6% pf.	l108½	105½	109
Elec. Bd. & Sh. Sec., com. $1—no par	l 71	67½	73½
Electric Household Util.†	a 15½	11	14½
Elec. Investors, 6% pf.—no par.	93	92	94
Elec. Investors, com.†—no par.	38	32½	40½
Elec. Investors, 10% pd. receipts.	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	k102½	96	103
Elec. Pwr. & Lt., ctfs., 40% pd.	111½	103½	112½
Elec. Pwr. & Lt., ctfs, full pd.	k111	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	20½	16½	21½
Elec. Refrig. cap.†	24½	22½	37½
Elec. Ry. Securities, com.—no par.	m 6	....	....
Elec. St. Battery com. $5.25—no par	68½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	k101½	99	101½
Emerson Elec., pf.	m108½	108½	108½
Empire Pwr., ptc.†	35	....	....
Engr. Pub. Serv., $7 pf.—no par.	104½	93½	105
Engr. Pub. Serv., com.—no par	27½	21½	28
Eureka Vacuum Cleaner, com. $4—no par.	73½	60½	73½
FAIRBANKS MORSE, 7% pf.	k114	107½	112
F.-M., com.—$3—no par.	k 40	37½	43½
Federal Lt. & Trac., com. $1.40.	44½	37½	47
Federal Lt. & Trac., $6 pf.—no par.	96½	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	k110	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	70	68	72
Galveston-Houston Elec., com.	k 25	28	30
Gen. Elec., $3 com.—no par.	97½	81	100½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	43½	34	47½
Gen. G. & E. (Del.) com. B—no par.	41½	35½	43½
Gen. G. & E. (Del.) pf. A. $8—no par.	118	113½	116
Gen. G. & E. (Del.) pf. A $7—no par.	k105	100	107½
Gen G. & E. (Del.) pf. B $7.	k104	96	104
Gen. Pub. Serv., $7 conv. pf., no par	109	105½	109
Gen. Pub. Serv., com., no par.	14½	11½	14½
Ga. Lt., Pwr. & Rys., 6% pf.	91	87	92
Ga. Lt., Pwr., & Rys., com.	m 60	....	....
Ga. Ry. & Pwr., 8% pf.	k123	119	123
Ga. Ry. & Pwr., 7% pf.	112½	106	110
Gt. Western Pwr., 7% pf.	h103	....	....
IDAHO PWR., 7% pf.	107	103	105
Ill. No. Utilities, 6% pf.	88	88	92
Ill. Pwr. & Lt., 7% pf.	100	99	101
Ingersoll Rand com. $8.	92	92	96½
Int. Combus. Engr., com. $2—no par	51½	43½	64
Int. Util., Class A—$3.50—no par.	34½	28	36
Int. Utilities, Class B—no par.	4½	3	5½
Interstate Pwr., pf.—$7—no par.	k95½	93	98
Interstate Pub. Serv., 7% pf.	99½	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT., 7% pf.	101	97½	103
Jersey Cent. Pwr. & Lt., 7% pte. pf.	k115	111	115
Jersey Cen. Pwr. & Lt., com.—no par	k 25	....	....
Johns-Manville, com.†—no par.	68½	55½	73½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, May 14. lBid price Wednesday, May 18. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday May 17	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	114¼	112	115
Kansas Gas & Elec., 7% pf.	f107	103	106
Kentucky Hydro-Elec., 7% pf.	m 96½	94¼	97¼
Kentucky Sec.,6% pf.	86	83	87
Kentucky Sec., 5% com.	109½	110	115
Kentucky Utilities, 6% pf.	96	95	97
Keystone Pwr. & Lt., 7% pf.	97	96½	99
LACLEDE GAS LT., 12% com.	228½	173¼	235
Lehigh Pwr. Sec., com.—no par	19	15	20
Long Island Ltg., 7% pf.	110	107	109
Long Island Ltg., com.†—no par	143	139	153
Los Angeles Gas & Elec., 6% pf.	99	98	100½
Louisville Gas & Elec., cl. A. $1.75	26¾	23¼	27¼
MAN. ELEC. SUPPLY, cap. $5—no par	68¼	53¼	72
Manila Elec., com.†—no par	k 43½	40	46
Maytag Mfg., com. .50—no par	31¼	23¼	32¼
Memphis P. & L., pf.—$7—no par	107	107	109
Metropolitan Ed., pf.—$6—no par	98½	93	97
Metropolitan Ed., pf.—$7—no par	106	104	108
Metropolitan Ed., com. $5—no par	67	....	....
Middle West Utilities, 7% pf.	a109	105¾	113¾
Middle West Util., 8% pr. lien	a121	117½	121
Middle West Util., com. $6—no par	a103	108	103
Midland Utilities, pr. ln. 7% pf.	a103	98	103
Midland Utilities, 7% pf. A	a 99	96½	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	k101	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k99	98	101¼
Minn. Pwr. & Lt., 7% pf.	f106¼	104	106
Miss. Pwr. & Lt., $8 pf.	110	106	111
Miss. River Pwr., 6% pf.	98½	94	97
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	106	100	109
Mohawk Hudson Pwr., 2d pf.—$7—no par	104	98	105
Mohawk Hudson Pwr., com.—no par	24	20½	27
Montana Pwr., 7% pf.	m123	118¼	123
Montana Pwr., 5% com.	100	81½	101¼
Montreal Pwr., 7% com.	f 85½	....	....
Mountain States Pwr., 7% pf.	99½	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	105
National Carbon, 8% pf.	m136	130½	137½
National Elec. Pwr., A†	24½	23½	25¼
National Elec. Pwr., 7% pf.	a 97	93½	97¼
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	107½	101	107½
National Pwr. & Lt., com.†—no par.	22½	19½	23½
National Pub. Serv., 7% pf.	96	93	99
National Pub. Serv., 7% ptc., pf.	113	108	115
National Pub. Serv., A com. $1.60—no par	21½	18¼	22½
National Pub. Serv., B com.—no par	m 19½	14	20½
Nebraska Pwr., 7% pf.	f109	106	109
Nevada-Calif. Elec., com.	m 29½	25¼	31
New Brunswick Pwr., 7% pf.	55	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	100½	98¼	101
New Eng. Pub. Serv., pf. $7	95	95	97
N. J. Pwr. & Lt., 6% pf.	95½	92	94
New Orleans Pub. Serv.—7% pf.	105	103	105
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	102	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25	29	27¼	29¼
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50	51½	50	52
No. Amer., com.—no par	48¼	45½	50½
No. Amer. Edison, $6 pf.—no par	100½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	98	93	97
Northeastern Pwr., com.	17	14½	18½
No. Indiana Pub. Serv., 7% cum. pf.	104	102	104
No. N. Y. Utilities, 7% pf.	104½	103	105½
No. Ohio Pwr., com.—no par	11½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	90	90	93
No. Ont. Lt. & Pwr., 6% pf.	92	86	94
No. Ont. Lt. & Pwr., 4% com.	k 74	73	78
No. States Pwr., (Del.) 7% pf.	105	100½	105½
No. States Pwr., (Del.) 8% com.	116½	109½	118
No. Texas Elec., 6% pf.	68	65	70
No. Texas Elec., com.	39	27	36
OHIO BRASS, com. B $4—no par.	82	74	85
Ohio Brass, 6% pf.	102	100	103
Ohio Gas & Elec., 7% pf.	102	95	103½
Ohio Pwr., 6% pf.	101½	96	99
Ohio Pub. Serv., $6 pf.	95	95	96½
Ohio Pub. Serv., 7% pf.	107	103	108½
Ohio River Edison, 7% pf.	108	103	108½
Oklahoma Gas & Elec., 7% pf.	100	....	....
PACIFIC GAS & ELEC., 6% pf.	25½	24½	26
Pacific Gas & Elec., 8% new com.	37½	31	37½
Pacific Pwr. & Lt., 7% pf.	f104	102	104
Parr Shoals Pwr., 6% pf.	m 92	....	....
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 74½	71½	75
Penn-Ohio Edison, 7% pf.	103½	97½	104½
Penn-Ohio Elec., 7% pf.	100	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	k102	99	102
Penn-Ohio Pwr. & Lt., 8% pf.	109	109	112
Penn Pwr. & Lt.—$7—no par	f109	107	108½
Penn Wtr. & Pwr., 8% com.	a191	176	191½
Phila. Co., 6% pf.—50	k 52½	50	53
Phila. Co., com.—50	k106	85½	110
Phila. Elec., 8% com.—25	c 51½	46½	54
Portland Elec. Pwr., 7% pf.	99	97½	100
Portland Elec. Pwr., 6% pf.	k 80	78	83
Portland Elec. Pwr., 6% 2d pf.	50	....	....
Portland Elec. Pwr., com.	24	22	30
Potomac Elec. Pwr., pf.	f108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par	k 28	28	33
Pwr. Sec., com.—no par	k 6	5	8
Public Serv. of Colorado, 7% pf.	101	....	....
Pub. Serv. of N. J., 6% pf.	113½	108½	115½
Pub. Serv. of N. J., 7% pf.	k130	125	131½
P. S. of N. J., $2 com.—no par	40½	32	40½
Pub. Serv. of No. Ill., 6% pf.	a105½	102	105½
Pub. Serv. of No. Ill., 7% pf.	a115	112½	116½
P. S. of No. Ill., com. $8—no par	a136	130½	142
Pub. Serv. of No. Ill., $8 com.	a136	132	139
Pub. Serv. of Okla., 7% pr. ln.	99	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	108½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	108	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par	86	....	....
Puget Sound Pwr. & Lt., com.	28½	29½	33½
RADIO CORP. OF AMER., $3.50 pf.—50	k 49½	49	53
Radio Corp. of Amer., com.—no par.	k 46½	41½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k135	112	135
Rochester Gas & Elec. 7% pf.B	106	105	107
Rochester Gas & Elec., 6% pf. C	102½	101½	103½
Rochester Gas & Elec., 6% pf.D	104½	101	103½
SAFETY CABLE, com. $4	k 58½	52½	64½
San Joaquin Lt. & Pwr., 7% pf.	107	105	108
St. Joseph Ry., L., H. & P., 5% pf.	72	70	73
Servel Corp.	k 7½	5½	10½
Sierra Pacific Elec., 2% com.	24	....	....
Sioux City Gas & Elec., 7% pf.	103	99	101½
Southeastern Pwr. & Lt., pf.—$7 no par	f105	....	....
Southeastern Pwr. & Lt., pfc. pf.	d 77½	....	....
Southeastern Pwr. & Lt., com.—no par	32½	29½	33½
So. Calif. Edison, 8% pf.	35	36½	38
So. Calif. Edison, 7% pf.	2[illegible]	27½	28½
So. Calif. Edison, 6% pf.	25½	24½	25½
So. Calif. Edison, 8% com.	34½	31½	34½
Southern Cities Utilities, 7% pf.	85	81	86½
Southern Cities Utilities, com. $4	36	....	....
Southwestern Lt. & Pwr., A $3	63	60	65
Southwestern Lt. & Pwr., B	63	60	65
Southwestern Lt. & Pwr., $6 pf.	88	83	86
Southwestern Pwr. & Lt., 7% pf.	k108½	103	108½
Springfield (Mo.) Ry. & Lt., 7% pf.	99	95	100
Standard Gas & Elec., 8% pf	63¾	57½	64
Standard Gas & Elec., 7% pr. pf.	108	103	106½
Standard G. & E., com. $3.50—no par	57½	54	58½
Standard Pwr. & Lt., 7% pf.	101	98	100
Staten Island Edison, pf.—$6—no par	101	99	101
Superheater, $6 com.—no par	180	....	....
Syracuse Lighting, 7% pf.	105	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.—no par	300	....	....
TAMPA ELEC., com. $2	63	49	63
Tenn. Elec. Pwr., 6% pf.	96	92	94½
Tenn. Elec. Pwr., 7% pf.	106	103	106½
Terre Haute, Ind. & East. Trac., 5% pf.	20	20	25
Terre Haute, Ind. & East. Trac., com	1	1	3
Tex. Pwr. & Lt., 7% pf.	f109	106	108
Tide Water Pwr., 8% pf.	108	105	108
Timken Roller Bear., com.—$4 no par	95½	78	95½
Toledo Edison, 8% pf.	k116½	115	118
Toledo Edison, 7% pf.	k107½	105	108½
Toledo Edison, 6% pf.	k 96	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	95½	90	97
UNITED GAS & ELEC., 6% pf.	100	98	101½
United Gas & Elec., com.—no par	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50	c107½	89½	107½
United Lt. & Pwr., pf.—$4—no par.	51½	49	53½
United Lt. & Pwr., pf.—$6.50—no par	97	87	97
United L. & P., com. A .48—no par.	14	12½	15½
United L. & P., com. B .48—no par.	k 15	16	18
Utah Pwr. & Lt., 7% pf.	f108½	104	107
Utica Gas & Elec., 7% pf.	107	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95	93	98
Utilities Pwr. & Lt., com. A $2	30	27	31½
Utilities Pwr. & Lt., com. B $1—no par	16½	13½	16½
VERMONT HYDRO-ELEC., 7% pf.	96	95	97½
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	70	....	....
WAGNER ELEC., 7% pf.	b 85	68	88
Wagner Elec., com.—no par	b 34½	18½	32½
Washington Ry. & Elec., 5% com.	j240	....	....
Washington Ry. & Elec., 5% pf.	j 91½	....	....
Washington Wtr. Pwr., 8% com.	142	136	140
West Penn Elec., 7% pf.	108½	102	110
West Penn Elec., Cl. A $7	106	97½	110
West Penn Pwr., 7% pf.	115	111	115½
West Penn Pwr., 6% pf.	106½	100½	107
West Virginia Lt., Ht. & Pwr., 7% pf.	93	94	96
West Va. Utilities, 7% pf.—50	49½	48	51½
Western Pwr., 7% pf.	99	98	101½
Western States Gas & Elec., 7% pf.	98	96	98
Western States Gas & Elec., com.	21	....	....
Westinghouse Elec. & Mfg., 8% com.—50	75½	67½	76½
Weston Elec. Instrument, Cl. A $2—no par	33½	30½	34½
Weston Elec. Instrument, com.—no par	16½	15	18½
Wheeling Elec., 6% pf.	100	95	97
Worthington Pump, 7% pf. A	52	46	54½
Worthington Pump, 6% B	45	40	46
Worthington Pump, com.	36½	20½	36½
YALE & TOWNE com. $5—25	k 76	70½	77

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, May 14. lBid price Wednesday, May 18. mLatest quotations available. †Dividend rate variable.

Georgia Power Elects New Directors.—Philip Phinizy of Athens, Ga.; John M. Graham of Rome, George Patterson of Macon and J. Leonard Rountree of Summit have been elected members of the board of directors of the Georgia Power Company.

Security Holding Corporation Organized in Canada.—A new utility security holding corporation has been organized in Canada under a Dominion charter which has for its purpose the acquisition of foreign securities, as the title "Foreign Power Securities Corporation, Limited," implies. Primarily this corporation is interested in hydro-electric operating companies in France, where an excellent field is considered to exist for further development. The company has been organized by the Canadian investment banking house of Nesbitt, Thomson & Company, Ltd. The company is capitalized at $5,000,000 6 per cent cumulative participating preferred shares and 100,000 shares of no-par-value common stock. The prospectus states that Foreign Power Securities was organized to acquire selected securities of electric light and power companies operating in foreign countries. It has acquired a substantial interest in the securities of *L'Energie Industrielle*, and indirectly in all its subsidiaries, as well as in two of them directly. These are *L'Union Hydro-Electrique Americaine* and the *Société Hydro-Electrique du Sud-Est*.

City System Electric Earnings 2 per Cent of National

In "Financial Statistics of Cities Having a Population of Over 30,000" for the year 1925, recently issued by the Bureau of the Census, it is shown that the revenue of cities within the designated class received from the sale of energy for electric light and power in the United States amounts to $31,178,574. This is divided up into groups as follows:

Population of Cities	Revenue for Electric Light and Power
500,000 and over	$13,785,476
300,000 to 500,000	3,794,997
100,000 to 300,000	3,512,218
50,000 to 100,000	7,253,930
30,000 to 50,000	2,831,953

In the first group the leading city is Los Angeles, with a revenue of $10,232,063. The next is Cleveland, with a revenue of $2,923,729. The only city in the second group is Seattle. In the third group most of the revenue is received in two cities, Kansas City, Kan., and Tacoma, Wash. In the fourth group there are three cities having a revenue exceeding $1,000,000, namely, Jacksonville, Fla., Lansing, Mich., and Pasadena, Cal. The last group contains seven cities, with a revenue ranging from $320,000 to $548,000.

Including those cities in which the revenue from this source is compara-

tively small, there are 22 cities in the country having a population of 30,000 or more which derive revenue from the sale of energy for electric light and power. The revenue from this source was approximately 2 per cent of the entire revenue of the industry in 1925.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Mar. 31 1927	1926
American Power & Light	61,124,667	53,441,969
Baton Rouge Electric	990,087	842,827
Blackstone Valley Gas & Elec.	5,607,635	5,209,585
Cape Breton Electric	634,038	563,873
Carolina Power & Light	8,457,753	7,201,040
Columbus Electric & Power	3,821,598	2,914,442
Community Power & Light	4,122,816	3,665,687
Consumers Power	24,732,676	21,563,584
Detroit Edison	3,726,370	3,527,328
Eastern Texas Electric	6,020,715	4,014,250
Edison Elec. Illg. of Brockton	1,809,743	1,693,513
Electric Light & Power of Abington & Rockland	582,995	558,971
El Paso Electric	2,887,596	2,613,245
Electric Power & Light	50,953,884	46,988,217
Fort Worth Power & Light	2,848,101	2,842,073
Fort Worth Power & Light*	2,846,437	2,835,725
Galveston-Houston Elec.	4,768,972	4,002,754
General Gas & Electric	25,037,848	22,057,134
Idaho Power*	2,880,439	2,849,375
Jamaica Public Service*	661,705	630,952
Lowell Electric Light	1,744,187	1,651,602
National Power & Light	34,460,252	30,682,085
Nebraska Power	4,500,599	4,202,850
Nebraska Power*	4,461,398	4,189,616
New Bedford Gas & Edison Lt.	4,201,828	4,030,262
North Texas Electric	2,551,807	2,447,993
Pacific Power & Light	3,749,158	3,623,301
Pacific Power & Light*	3,747,052	3,610,128
Penn Ohio Edison	13,073,283	11,490,774
Public Service Co. of N. J.	108,265,352	97,700,718
Puget Sound Power & Light	13,876,095	12,998,718
Savannah Electric & Power	2,245,044	2,035,780
Sierra Pacific Electric	1,265,538	1,146,472
Southern California Edison	28,768,090	25,431,234
Tampa Electric	4,855,287	3,853,927
Tennessee Electric Power	11,998,918	11,781,458
Texas Power & Light*	8,139,478	6,961,414
Texas Power & Light	8,306,361	7,006,235
United Light & Power	42,595,694	37,790,211
Utah Power & Light*	10,604,309	9,949,278

* Twelve months ended Feb. 28.

More Bonds Pronounced Legal for Investment in Massachusetts.—The following securities have been added to the list of legal investments for savings banks in Massachusetts:

Bath & Brunswick Power & Light Company, 1st and refunding 5s, 1930.
Oxford Electric Company, 1st mortgage 5s, 1936.
Manchester Traction, Light & Power Company, 1st and refunding 5s, 1952.
Manchester Traction, Light & Power, 1st and refunding 7s, 1952.
Eastern Wisconsin Electric Company, 1st lien and refunding mortgage, series A, 6s, 1942.
Eastern Wisconsin Electric Company, 1st lien and refunding mortgage, series B, 6½s, 1948.
Wisconsin Power & Light Company, 1st lien and refunding mortgage, series C, 6s, 1944.
Wisconsin Power & Light Company, 1st lien and refunding mortgage, series D, 5½s, 1955.
Wisconsin Power & Light Company, 1st lien and refunding mortgage, series E, 5s, 1956.
Empire District Electric Company, 1st mortgage and refunding 5s, 1952.
Ozark Power & Water Company, 1st mortgage 5s, 1952.
Pacific Gas & Electric Company, 1st and refunding mortgage, 7s, 1940, series A.
Pacific Gas & Electric Company, 1st and refunding mortgage, 6s, 1941, series B.
Pacific Gas & Electric Company, 1st and refunding mortgage, 5½s, 1952, series C.
Pacific Gas & Electric Company, 1st and refunding mortgage, 5s, 1955, series D.

The first mortgage 5 per cent bonds of 1937 of the Roland Park Electric & Water Company were taken from the list.

Maytag Company Declares Extra Dividend.—The Maytag Company, Newton, Iowa, has declared a 25-cent extra dividend.

Canadian Electric Census

Figures for 1925, Just Issued, Show that Total Generator Rating Is 2,844,709 Kva.

THE central electric station industry in Canada showed a substantial growth during 1925, according to the Census of Central Electric Stations just issued by the Dominion Bureau of Statistics. The generating capacity was increased by 562,663 kva., or 24.6 per cent, the total capacity being 2,844,709 kva. The capital investment was increased by $98,155,994, or 15.6 per cent, and the output was greater than during 1924 by 795,182,000 kw.-hr., or 8.5 per cent. The net increase in the number of power plants was 31, of which 11 were hydraulic and 20 were fuel power plants, 18 of these latter being small plants in Saskatchewan. The hydraulic electric stations generated over 98 per cent of the total output of the industry, and their capacity was over 95 per cent of the total.

Hydraulic stations increased 553,469 kva. in capacity during 1925, more than half of the increase being eight units, rated at 240,000 kva., of the Duke-Price development on the Saguenay River, in Quebec. The Southern Canada Power Company completed its power house at Hemming Falls on the St. Francis River near Drummondville, Quebec, adding 36,000 kva. Another large addition to the industry was the initial installation in the hydraulic plant of the Ottawa River Power Company at Bryson, Quebec, with a capacity of 22,500 kva.

In Ontario the Hydro-Electric Power Commission installed at its Queenston plant the eighth and ninth units, with a rating of 54,000 kva. each. It also added two hydraulic turbines to its plant at South Falls in the Muskoka River, increasing the generator capacity of the Georgian Bay system by 4,000 kva. Two new units were placed in operation in its plant at Cameron Falls on the Nipigon River, adding 21,200 kva. to the Thunder Bay system. In its Central Ontario system new turbines were installed in the power houses at Dam No. 9 on the Trent River, adding 4,200 kva. to the capacity of that system. The Keewatin Power Company increased the capacity of its power house at Kenora by 15,600 kva., and the Wahnapitae Company added two new hydraulic units with a capacity of 5,000 kva. to its plant on the Wahnapitae River above Sudbury.

In British Columbia the large additions were 13,125 kva. by the Western Power Company at its Stave Falls plant and 35,000 kva. by the West Kootenay Power Company, which completely reconstructed its plant at the Lower Bonnington Falls on the Kootenay River, the old plant having been dismantled in 1924. In Manitoba the only large addition was 6,500 kva. by the city of Winnipeg in its hydro-electric plant on the Winnipeg River.

The largest increase in capital was in the Quebec stations, amounting to $62,520,825, or 63 per cent of the total increase, and virtually all of this was in the hydro-electric stations.

The net revenue received by all stations was $79,341,584 for 10,110,459,000 kw.-hr., or an average of 0.78 cent per kilowatt-hour. This average includes electricity sold for both lighting and power purposes, including large blocks of power sold in some cases almost at cost to manufacturing companies subsidiary to the generating company. It also includes off-peak power sold for heating water and pulp and paper mills and for other industrial purposes; also all transformer and line losses.

The stations in Ontario and Quebec contained over 80 per cent of the capacity of the primary power of all central electric stations in Canada, Ontario having 329 units with an average capacity of 4,441 hp., and Quebec 256 units with an average capacity of 5,527 hp. The largest units in Canada in the central electric station industry are the nine turbines in the Queenston power house of the Ontario Hydro-Electric Power Commission, rated at 55,000 hp. each.

The total output of all stations in Canada during 1925 was 10,110,459,000 kw.-hr., an average of 17,958,000 kw.-hr. per power house and an average of 1,080 kw.-hr. per capita, based on an estimated total population for Canada of 9,364,200. Although the fuel power plants were quite numerous, comprising almost 50 per cent of the total, on the whole they were small and generated less than 2 per cent of the total output. The output of the hydraulic power plants aggregated 9,941,604,000 kw.-hr., or more than 35,000,000 kw.-hr. per power house.

Pennsylvania Water & Power Vote Stock Split-up—Stockholders of the Pennsylvania Water & Power Company voted May 10 to change the authorized capital stock from 135,000 shares, par $100, to 540,000 shares of no par value, four new shares to be exchanged for each share now held.

Initial Common Dividend Declared.—Directors of the Penn-Ohio Edison Company have declared an initial quarterly dividend of 25 cents in cash and an extra dividend of one-fiftieth of a share in stock, payable May 2 to common-stock holders of record April 15.

New England Association Adds to Directorate.—The following members have been added to the board of directors of the New England Power Association: John Johnston of Pawtucket, R. I., and W. J. Callender, J. J. Bodell, Louis C. Gerry, Edward B. Aldrich and Luke C. Bradley, all of Providence.

International Power Securities Adds to Directorate.—The directorate of the International Power Securities Corporation has been increased by the election of two new members to the board—Gerard Swope, president of the General Electric Company, and Newcomb Carlton, president of the Western Union Telegraph Company.

Hartford Electric Votes Two-Million-Dollar Stock Increase.—Directors of the Hartford Electric Light Company have voted to increase the capital $2,000,000, half of the amount recently authorized by stockholders. The stock will be issued at a par of $100 to stockholders of record April 12 in the ratio of one for six. Rights will expire June 15.

Manufacturing and Markets

Economic Ills Diagnosed

Forty-seven Countries Discuss Methods of Recovery at International Conference—Diagnoses Agree—Interdependence of Nations Universally Recognized

By Edward J. Mehren
Vice-President McGraw-Hill Publishing Company, Inc.

AFTER representatives of 47 countries had listened to a diagnosis of the world's economic difficulties at the International Economic Conference, Geneva, Switzerland, and twelve countries had been heard from, the encouraging feature noted was that the diagnoses agreed. It is an interesting gathering. The Western world dominates in numbers, but even its composition shows variations that give the interest of wide diversity. The British and the French and the Germans are present in all their strength, but equally imposing in size of representation, by delegates and experts, are Poland, Austria, Bulgaria, Esthonia, Hungary and Latvia, while Czechoslovakia outdoes all comers with the numerical strength of its expert group. Then there are such other newcomers in the society of nations as the Free City of Dantzig and the Irish Free State. The British Empire registers strongly with its dominions and India; the Orient contributes Japan, China and Siam; Africa sends Abyssinia, while Latin America is well represented.

The presence of the Russians was the high excitement of the initial days of the conference and was looked on as a favorable omen. Not that any one believes in the rapid conversion of the bolshevists from their program; but they come, they listen, they confer—that is considered progress. Their country is looked upon as a formidable element in the economic world. If confidence in her government can be developed, trade will grow on that confidence, and Russia with large consuming power could be an important factor in European recovery. America's presence, too, brings frequent and highly commendatory comment. Such, then, is the setting. Truly a "society of nations" as tongues other than English describe the League of Nations.

The Diagnosis

What is the diagnosis on which the speakers, each speaking for his delegation, so far agree? There are, so they indicate, a number of diseases: First, that purchasing or consumptive power was curtailed by the war; second, that many trade barriers, and not merely high tariffs, have been erected, such barriers as fluctuating exchanges, high freight rates, troublesome customs formalities, quickly changed tariffs, which discourage long-time contracts, etc. Of these diseases the restriction of purchasing power was most frequently stressed, but suggested remedies were not so readily forthcoming. Prof. Karl Gustav Cassel (Sweden), in a learned address which will appear in a forthcoming issue of the Electrical World, intimated that the restored purchasing power of backward countries might be a powerful stimulus if capital for their development were forthcoming in larger volume, and Karl F. von Siemens (Germany), again by intimation, pointed out the burdens to industry caused by the expansion of government functions and government intervention in industry. Dr. Zimmerman (Holland) also developed the same thought. Enlarged government functions withdraw men from productive enterprise and make them a tax on industry and thus on consumption. Government interference also burdens industry. The result is the reduction of the purchasing power of the nation.

Among government interventions Herr von Siemens cited high customs tariffs not justified by natural differences, import prohibitions, export bounties and wage regulation. All these mislead industry into self-sufficiency, discourage technical progress and, in sum, depress the standard of life.

As to trade barriers, the International Chamber of Commerce, represented in the discussion by Walter Runciman, has proposed a well-thought-out series of remedies which have the concurrence of its 22 national committees in as many countries. Chief among these is a suggestion for stabilization of tariffs, that is, that tariffs shall not change too often and without due notice. On this subject there will be more later, when the conference resolves itself into committee.

Unemployment

Naturally the question of unemployment has been very fully traversed, for it is recognized as one of the most serious results of Europe's economic dislocation. It is inevitably tied up with lack of purchasing power, and the remedy for the latter is necessarily found in the remedy for the former. But in the handling of this subject there has been a solicitude that goes beyond its consideration as a cold economic fact. The human distress is keenly felt and expressed.

Another note frequently struck in the speeches was the insistence that the chief responsibility of leaders of industry and government is to improve the living conditions of the people at large. Whether this is a new note in Europe—a new note for the employer—I do not know. Certainly it does not accord with the impression we have in America of a cast-iron class distinction that refuses to recognize the ills of others. In Herr von Siemens' address this was especially striking. Again and again he came back to this as a major objective of those in responsibility, whether in government or industry.

Interdependence of Nations

One other point brought universal agreement—that nations are interdependent and that their dislocations react on each other. In fact, the conference itself is the best evidence that the interdependence is a moving thought in Europe. A tangible suggestion was Herr von Siemens' comment on the conditions necessary for international cartels, a subject sure to receive much discussion. He suggested that they were feasible only under three conditions: (1) that the industries in countries concerned must be accustomed to co-operate and come to an understanding; (2) that constituent national groups can only be formed where the number of those concerned is not too large, and (3) that the agreements must cover a commodity which is clearly definable and also comparable.

Dr. Zimmerman stressed the growing importance for present industrial countries of their potential home market, since backward countries tend to establish their own industries and thus cut down their imports of manufactured goods. This means an effort to increase home consumption and therefore to raise the standard of living.

Mr. Jouhoux (France) proposed the organization of two economic bodies, one to meet at least every three years to lay out the policies for the second body, which would be a standing economic council to carry on, through committees, studies of important economic questions. Finally, to an American, there was a special appeal in two points of Herr von Siemens' address—his appeal, first, for the preservation of individualism and, second, for open-mindedness and flexibility in one's economic and industrial attitude. One might have been hearing an American in the forceful statement that "economic and technical progress is achieved in the first place by the industrious and untiring work of the individual and by his belief in the success of his endeavors. If individualism is eliminated from economic activities, there can be no economic life." He pointed out that large-scale organizations endanger individualism and that a main concern of the manager of such an enterprise is to nurture individual effort and initiative. May not his commendation of open-

mindedness contain the secret of Germany's remarkable industrial progress before and since the war?

POSSIBLE RESULTS

What will be the result of this world conference? The question is asked and answered dozens of times each day between sessions and in hotel corridors. The answer is always the same: Do not expect too much. The problems are extremely complex. The solution must be worked out slowly. But the groundwork can be laid here. The superstructure will come at a later similar gathering. Despite the difficulty, though, some early results are possible and may be expected. Walter Runciman (England) put the broad fundamental well in these words: "Those who are concerned to maintain business prosperity in all countries are convinced that a mutual understanding in international economic and business problems is the surest guarantee for a growing volume of trade and for the maintenance of the higher standards of life and comfort which are the legitimate aspirations of modern democracy."

Allis-Chalmers Acquires Pittsburgh Transformer

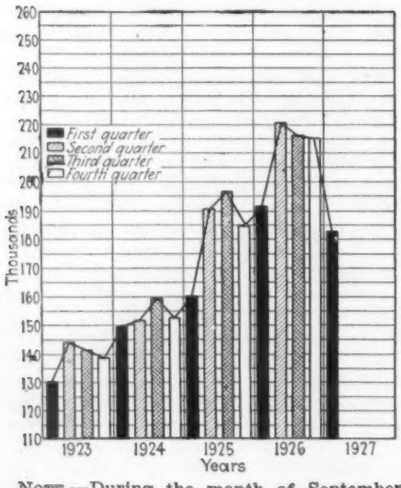
Pittsburgh Company Continues as Heretofore—R. V. Bingay Made Director of Allis-Chalmers

ACQUISITION of the Pittsburgh Transformer Company, Pittsburgh, by the Allis-Chalmers Manufacturing Company of Milwaukee has been announced. This consolidation will give the Allis-Chalmers company a complete line of transformers covering all voltages, sizes and types combining these products of the two companies, their engineering, research, experimental and shop facilities, as well as experienced sales and service forces. The Allis-Chalmers company, among its various lines of manufacture, has been building transformers for many years, particularly in high-voltage, large-sized units, and has been doing a very extensive business in what ranks among the more important of the company's electrical products.

Plans for operations have not all been fully developed, but operating as an independent company the Pittsburgh Transformer Company will continue the manufacture and sale of its various lines in Pittsburgh in its own buildings, which have been designed and adapted for the manufacture of transformers exclusively. The facilities of the Pittsburgh company's plants will supplement the other Allis-Chalmers plants at Milwaukee and Cincinnati. R. V. Bingay, president of the Pittsburgh Transformer Company, whose efforts have in a large measure contributed to the growth of the company from a small beginning to its present important position, and who is an outstanding figure in the transformer field, is to become a director of the Allis-Chalmers company. The Pittsburgh company in continuing the manufacture and sale of its various lines will have as its officers R. V. Bingay, president; S. McN. Johnston, formerly secretary and treasurer, vice-president; R. Dill, treasurer, and W. A. Thompson, secretary. For the present the sales representatives of both companies will conduct their sales operations as they have done in the past.

The Pittsburgh company is a Pennsylvania corporation which in 1901 did a business of $20,000. The gross sales of the company have grown in 25 years to $6,000,000 per annum, and the company now is the largest exclusive manufacturer of transformers in the United States with a roster of employees numbering more than 600. The average wage paid the entire working force of the company is $1,880 yearly, whereas the average of 21 cities in the United States is $1,321.50.

Sales of Electric Washing Machines by Quarters



NOTE.—During the month of September, 1926, sales of electric washing machines amounted to 76,308 and established a new monthly sales record in the history of the washing-machine industry.

Business Conditions

SALES in the electrical industry are in fair volume, but are somewhat below sales for the same period last year. Central-station companies are buying steadily and a number of active negotiations cover some very large turbo-generator units. One unit of about 100,000 kw. capacity will be purchased within thirty days by the Brooklyn Edison Company of Brooklyn, N. Y. Sales of general purpose motors are in steady volume, although industrial business is somewhat spotty.

In New England power apparatus is in active demand and sales of general-purpose motors are holding up well. A large amount of industrial plant betterment work is in progress in the metal working field. Utility companies are buying fiber conduit poles and line material on a liberal scale. Central-station orders pending in the New York district will reach a large figure, as a good deal of large turbo-generator equipment is included in the negotiations. Industrial business is spotty. In the Southeast business is quiet, for though inquiries are active, only orders for immediate requirements are being placed. The largest order received was from the Carolinas for motors and switchboard equipment amounting to approximately $14,000. Sales are steady in the St. Louis district, and the demand for construction material has been good. Some fairly large emergency orders were placed owing to the disastrous cyclone in and near Poplar Bluff, Mo. Such orders were mainly for transformers and line material. Business has accelerated somewhat in the Middle West, but a distinctly conservative policy in buying is noted. Activity is noted on the Pacific Coast and industrial plants are buying in good volume. Carload lot inquiries were prevalent. A number of new industrial installations are planned. Pumping motor business is only fair despite the late season. Construction of pulp and paper mills in the Puget Sound district are attracting much attention and several large orders are anticipated.

Copper Below Thirteen Cents—Zinc and Lead Also Decline

The non-ferrous metal market has been inactive and prices for each of the major metals are lower. Last week Thursday a fair business was done in copper at 13 cents delivered in the Connecticut valleys. Since then, however, buyers have shown practically no interest in the market. Small sales have been made at 13 cents in the East and 13¼ cents in the Middle West, but on Wednesday first-hand metal has sold at 12.875 cents delivered in Connecticut. Although producers until Wednesday have held consistently at 13 cents, and some are still asking that figure, a fair tonnage of second-hand metal for May delivery has changed hands at prices ranging from 12.825 cents to 12.875 cents. Various interpretations are placed on the April statistics that appeared last Thursday but it is clear that consumers are not greatly impressed. One interesting comparison shows that the average rate of world production for November, December and January was about 5 per cent higher than it has been during February, March and April, although there was a sizable decline in stocks of both blister and refined at the end of April. Lead has sold in reasonable volume during the last week, though it has been distinctly a buyers' market. The American Smelting & Refining Company maintained its New York

NEW YORK METAL MARKET PRICES

	May 11, 1927 Cents per Pound	May 18, 1927 Cents per Pound
Copper electrolytic	13	12.875
Lead, Am. S. & R. price	6.75	6.65
Antimony	13	12¼
Nickel, ingot	35	35
Zinc spots	6.45	6.35
Tin, Straits	68	67.379
Aluminum, 99 per cent	26	26

Base copper price May 18, 1927, 15 cents.

contract price at 6.75 cents until Monday, when, on hearing of price concessions by other sellers, it reduced its price to 6.65 cents. The reduction was accepted as a matter of course by buyers and did not stimulate business to any great extent. Buying of tin has been spotty, with no great excitement in the market. In spite of a great deal of talk zinc miners in Joplin continue to produce about 13,500 tons of concentrate per week against sales of about half that quantity in each of the last two weeks. The price has been cut to $38, and it is possible that material curtailment will be brought about soon.

Business in Southeast Quiet But Inquiries Are Active

Activities in the Southeast were very quiet, with central-station purchases considerably off and only orders for immediate requirements being placed. The largest orders reported were for $16,250 worth of copper wire for stock, stranded copper cable amounting to $4,000 and poles totaling $2,000. One company placed several orders during the week for tree and weather-proof copper wire totaling $10,000 and oil-circuit-breaker equipment amounting to something over $4,000. One company's activities in connection with the change of its direct-current underground system to alternating-current service were reflected last week in orders for wiring materials amounting to approximately $6,000.

Few orders are being received from industrial plants, though a satisfactory number of inquiries are in hand. The largest order received was from the Carolinas for motors and switchboard equipment amounting to approximately $14,000, while a new Georgia textile mill ordered street-lighting equipment totaling $5,000 for installation on the mill property and in the mill village. Central-station campaigns are serving to hold up merchandise sales to a reasonably satisfactory level, although not so high as for several weeks past. The very cool weather for the past two weeks has served virtually to kill fan sales except in the far southern portion of the territory.

Power Apparatus Active in New England District

Diversified buying of power equipment for central-station and industrial use featured the New England market. Rush bids were requested on a 30,000-kva. transformer installation for interconnection in central Massachusetts, and distribution transformer sales are in excellent volume. Sales of general-purpose motors are holding up well, current orders embracing a horsepower volume about equal to last year's figures. One machine builder bought about $17,000 worth of fractional-horsepower motors and another motor order totaled $8,500. A Massachusetts shoe factory purchased 75 motors aggregating $7,000, marking at least the beginning of a better feeling in this industry. A large amount of industrial plant betterment work is in progress in the metal-working field.

Interest is increasing in electrically heated stereotype pots for newspaper work, a 54-kw. outfit having been ordered this week for a Brockton journal, with inquiries from other sources. Another electric oven installation for bread baking has been sold in the Boston district. Central-station companies are buying fiber conduit, poles and line material on a liberal scale, one week's orders covering six carloads of cable for use in eastern Massachusetts, according to a leading jobber. Jobbers report a fair volume of trade, but complain that margins of profit are close, with some price cutting from smaller houses. Irons and portable lamps are moving fast. In the industrial field a 5,000-kw. steam turbine was sold for installation in Maine and a 650-kw. turbine with direct-connected generators and exciter for paper-mill work was also purchased. Building continues in very large volume. Retail sales have been hampered by cold weather.

Large Central-Station Orders Pending in New York District

Central-station buying in the New York district is fair but somewhat spotty, although a number of large negotiations are under way. Transformer sales have fallen off in the last few days and inquiries are decreasing. Switching equipment is in good demand and a good volume of orders for poles and cross-arms is reported. Sales of pole-line hardware are spotty and generally weak. A good volume of industrial sales is reported, and general-purpose motors are again in good demand. Motors for pumps, refrigerators and fans continue to find a ready market. Control apparatus is moving strongly, and several small sales of transformers to industrial buyers are reported.

Acceleration of Business Noted in the Middle West

Acceleration of business previously noticed in the Middle West is continuing. The volume transacted increased a trifle and an optimistic attitude is prevalent. The policy of hand-to-mouth buying is very much in evidence with industrial plants and utility companies alike. Central-station companies are pursuing a conservative policy, with careful attention being given to budgets. Maintenance purchases are quite large and help materially to increase the volume of business. Among the interesting orders placed were one for a substation construction job valued at $85,000, a fabricated steel order for plant extension valued at $70,000, 7,000 5-amp. watt-hour meters, 765 direct-current watt-hour meters, a large quantity of paper-insulated lead-covered cable and several carloads of bus bar copper.

Jobbers report a fair volume of business transacted. This is electric iron month and every inducement possible is being made to increase the volume of sales of this appliance. A fair quantity of irons are being sold, but the market is somewhat restricted. Sales of vacuum cleaners and washing machines continue good, and a remarkably large volume of business is accruing from portable lamps, one jobber selling about $40.000 worth in a two weeks period.

Activity Noted on Pacific Coast—Industrial Plants Buying

Machinery and power equipment orders on the Pacific Coast include an eleven-panel substation switchboard for Chico valued at $5,000, a carload of 10-in. suspension insulators for stock, 100 washing machine motors for Oakland, $7,500 worth of assorted motors for an oil refinery, and 20 small motors and a 25-kw. motor generator set for the new silk industry at Escondido near San Diego. Pumping motor business is only fair despite the late season. Power company inquiries cover one carload of 15-kv. pin-type porcelain insulators amounting to about $6,000, one carload of glass insulators costing about $2,800, one carload of guy wire and one carload of miscellaneous pole-line hardware. Carload lot inquiries seem to be prevalent, and similar requests have come from dealers for conduit. Construction of a combined office building and church valued at $3,500,000 will soon be started in San Francisco, and about $150,000 worth of hospital work will soon be figured on.

Construction of another paper mill on Puget Sound by the Zellerbach Corporation is reported assured and will cost about $2,500,000. Specifications for one-million-dollar pulp and paper mill for Aberdeen, planned by the Pacific States Pulp & Paper Company, are being written, and the Cameron Chandler Company expects to spend $10,000,000 for a pulp mill for the Juneau (Alaska) project of the Tongass National Forest. This company represents a syndicate of Pacific Coast newspapers. Contracts aggregating $100,000 and involving 1,100 poles and cross-arms, transformers, wire, insulators, etc., to be used in the construction of power lines from Durkee to Baker to Union City in Oregon have been awarded by the Eastern Oregon Light & Power Company. Motor sales made include several to a cold-storage plant in eastern Washington, an Olympia paper mill, a Seattle grain elevator and an eastern Oregon mill. Specifications are being written for motors for a one-hundred-thousand-dollar cold-storage plant at Chelan, Wash.

Sales Steady in the St. Louis District

The volume of general business in the St. Louis district has been normal with a few specially high points. As the direct result of the disastrous cyclone in and near Poplar Bluff, Mo., some fairly large emergency orders have been shipped to that section. They were almost all for transformers and every type of line material for restoring the distribution systems in the devastated towns and high-tension lines connecting different communities. One contract closed amounted to over $40,000 for motors, transformers and switching apparatus and was for a power company in northeastern Oklahoma. Another order was placed for additional motors and transformers, costing about $4,000, to be installed in the crushing and drying plant of a silica mine in St. Louis County. The demand for line construction material has been good.

Activities of the Trade

Westinghouse Reports Record Sales in Annual Statement

Sales of the Westinghouse Electric & Manufacturing Company for the year ended March 31, 1927, reached a record of $185,500,000, the largest in its history. The previous record figure of last year was exceeded by nearly $20,000,000. The net income available for dividends, $16,138,441, was exceeded only once before during the history of the company. The earnings per share of stock (preferred and common) were $6.80 or 13.8 per cent. Both classes of stock are now receiving $4.00 per share of $50 par value.

The company's cash position as recorded in its annual report shows that current assets total $120,000,000, whereas the current liabilities amount only to $18,000,000. Of the current assets, $72,000,000 consists of inventories, a reduction of more than $7,000,000 as compared with last year. The value of unfilled orders at the close of the year was $55,300,000, a slight increase over last year. The accompanying table gives the statement of consolidated income and profit and loss for the year ended March 31, 1927.

"The sales billed for the year reflect the improvement in operations due to the more efficient use of the manufacturing facilities added during the past two years," says Guy E. Tripp, chairman, in his report. "The cost of sales reflects the keenness of competition and slightly lowered prices. During the year financing operations were effected which reduced the fixed interest charges of the company by approximately $1,000,000 per annum. The volume of sales for export increased over the previous year. Competition for export business continues to be keen, but certain affiliations in the foreign field effected during the year should assist in securing a substantial volume of new business. The average number of employees during the year was 47,084. The number of stockholders is 38,469, average holding of shares is 62, and 40 per cent of the stockholders are women."

STATEMENT OF CONSOLIDATED INCOME AND PROFIT AND LOSS FOR THE YEAR ENDED MARCH 31, 1927

Gross Earnings:		
Sales billed.....		$185,543,087.18
Cost of Sales:		
Factory cost, including depreciation of property and plant and all distribution, administration and general expenses, and taxes		169,764,085.54
Net manufacturing profit.....		$15,779,001.64
Other Income:		
Interest, discount and miscellaneous income and profits.....	$1,358,259.83	
Dividends and interest on sundry stocks and bonds owned.....	1,227,354.34	2,585,614.17
Gross income from all cources.....		$18,364,615.81
Deductions from Income:		
Interest on bonds.		2,226,174.30
Net income available for dividends and other purposes.....		$16,138,441.51
Surplus, March 31, 1926.....	$51,715,396.43	
Surplus, March 31, 1926, of Pittsburgh Meter Company, deducted.....	786,247.13	
Adjusted surplus, March 31, 1926		50,929,149.30
Gross surplus....		$67,067,590.81
Profit and Loss Charges:		
Dividends, reserves, etc., as detailed on page 6.....		12,905,756.67
Surplus, March 31, 1927, per balance sheet.....		$54,161,834.14

Hotpoint Introduces New Appliance Sales Plan

A plan to assist electric light and power companies in selling more electric ranges, electric appliances, electric water heaters and electric refrigerators has been developed by the Edison Electric Appliance Company, 5600 West Taylor Street, Chicago. The plan covers a motion-picture electric cooking party arranged in conjunction with the local theater. A booklet published by the company contains complete details for making arrangements for the "movie" electric cooking party and explains the part the company will take in the plan.

The company states that this cooking party has been used with great success in many parts of the country and wherever introduced has resulted in additional sales of "Hotpoint" ranges for the central-station company in that place. The booklet now available is a revised second edition.

The General Electric Company has taken bids for the construction of a one-story addition to its plant at Fort Wayne, Ind., to be 45 ft. x 85 ft.

Hubbard & Company, Pittsburgh, announces that Joseph V. Smith, formerly general manager of the shovel interest of the company, has been appointed Pacific Coast manager for the electrical materials department, with headquarters at the Oakland (Cal.) plant.

The Detroit Stoker Company, Detroit, announces the appointment of A. Kastello as district sales representative for its eastern Canada and Montreal (Quebec) territories, with headquarters at 915 New Birks Building, Montreal. Detroit stokers are manufactured at St. Catherines, Ontario, for distribution throughout Canada.

The Lincoln Electric Company, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the appointment of Royal D. Malm as Western district sales manager, with headquarters at Chicago. For the past year Mr. Malm has had charge of Lincoln sales in the automotive industries with headquarters in Detroit.

The Fairbanks-Morse Company has secured a contract for 25 motors ranging from 75 hp. down from the Biles-Coleman Box & Manufacturing Company, Omak, Wash., for converting its plant to electric drive.

The Allis-Chalmers Manufacturing Company has secured a contract for motors and equipment for the Walton Lumber Company at Lowell, Wash., amounting to about $35,000. The contract calls for 90 motors ranging from 250 hp. down, a 400 hp. synchronous motor, and transformer equipment.

The Westinghouse Electric & Manufacturing Company has secured a contract for furnishing the generator for the completion of the third unit of the Watertown (N. Y.) municipal power plant at a cost of $29,925. With the completion of this third unit, the plant will have a capacity of 7,500 hp.

The Lamson Company, Syracuse, N. Y., announces that the Laube Electric Corporation will distribute Lamson "Ice Maid" refrigeration units in Rochester, N. Y.

The Frigidaire Corporation, Dayton, Ohio, according to an announcement of E. G. Biechler, president, is now on a production basis of four units per minute. The company expects during 1927 to double its unit sales of 1926.

The Westinghouse Electric & Manufacturing Company announces the appointment of H. C. Thomas as assistant general manager of the merchandising department. Mr. Thomas was formerly assistant to the manager of the merchandising department.

The Graybar Electric Company, Graybar Building, Lexington Avenue and Forty-third Street, New York City, announces the appointment of G. E. Chase as high-tension sales manager. Mr. Chase was formerly broadcasting sales manager of the company.

The Society for Electrical Development announces its removal from 522 Fifth Avenue, New York to the Graybar Building at 420 Lexington Avenue.

The Copper and Brass Research Association, 25 Broadway, New York, has issued a splendid booklet entitled "Wiring and Rewiring to Modernize the Home." The booklet is directed at the house owner in promotion of the adequately wired home and to show how readily wiring can be modernized.

The Iron Mountain Company, Chicago, announces that it is now placing on the market a small model "Zero-zone" electric refrigerator, selling at less than $200.

The Bridgeport Brass Company, Bridgeport, Conn., announces that Robert T. Kent, formerly superintendent of prison industries, State of New York, has been appointed general manager of the company.

The Monson Maine Slate Company announces the removal of its executive and sales offices from 112 Water Street, Boston, to new and larger quarters at 38 Chauncy Street.

New Equipment Available

Watt-Hour Meters

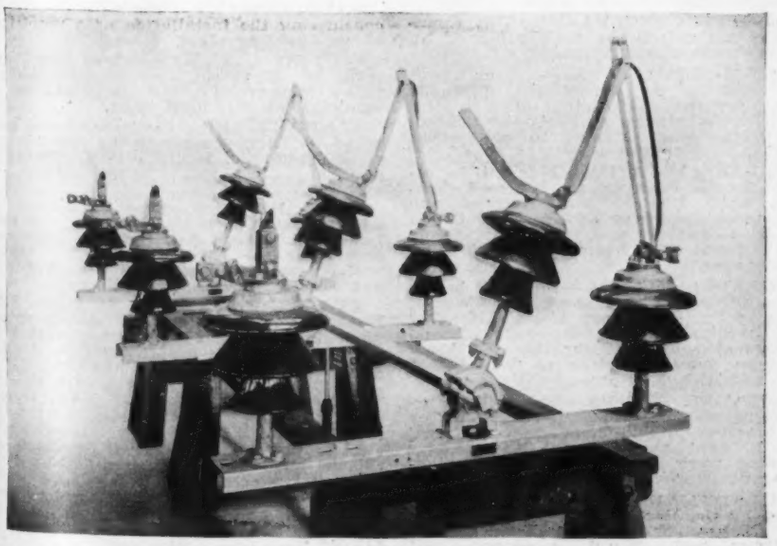
Two new types of watt-hour meters are being marketed by the Westinghouse Electric & Manufacturing Company, the OB polyphase watt-hour meter and the OB two-element, three-wire watt-hour meter. The OB polyphase meter is said by the manufacturer to have all the distinctive features of the single-phase OB type and is used on two-phase or three-phase circuits with either three-wire or four-wire distribution. Complete temperature compensation at both unity and low power factors is an additional feature of this new instrument.

The OB two-element, three-wire watt-hour meters are patterned after the Westinghouse single-element OB meter and have been designed to solve two major metering problems. On three-wire circuits, where greater accuracy is desired than is obtainable with the single-element meter, this new instrument may be used to advantage. By the use of this meter accurate metering of a three-wire service fed from a three-phase, four-wire network is also obtainable at low cost.

High-Tension Disconnecting Switch

A new rocker insulator type of group-controlled high-tension disconnecting switch, for use with insulators with standard bolt circle cap and pin mounting so that all insulators are interchangeable and replaceable, is being marketed by the Pacific Electric Manufacturing Company, San Francisco. Features of design claimed by the manufacturer are independent adjustment of the rocker insulator, self-aligning contacts and free and self-aligning bearings requiring no lubrication.

The switch is controlled with a handle fitted for locking with a standard padlock and passing over center in both the closed and open positions. Gravity tends to retain the switch in either the open or closed position. Particular attention has been given to the location of the holding-down bolt holes to facilitate quick and inexpensive mounting.



ROCKER INSULATOR TYPE OF GROUP-CONTROLLED HIGH-TENSION DISCONNECTING SWITCH

Portable Test Meter

A new portable meter to be used as a standard in meter testing has been introduced by the General Electric Company. The new meter, designated as type IB-7, is made for 110-220 volts, 25 or 60 cycles, and 1/5/20 amp. The manufacturer claims that the effects of variation in voltage, frequency and power factor are minimized to negligible values and that there is almost an entire freedom from temperature errors. On both full and light loads adjustments are made with micrometer screws. The meter is also provided with an adjustment for regulating its operation on inductive loads. The 1-amp. winding is protected from accidental overload or short circuit by a fuse, and a spare fuse is carried in the cover. A gasket between the top panel and the case makes the meter dust-proof and moisture-proof, and the dial chamber is similarly protected by a gasket between the flange and top panel. A zero setback device is controlled by a knurled bakelite knob, and the terminals are also of molded bakelite with positive grips.

Truck Crane

A new type truck crane mounting which permits the speedy mobility of a motor truck to be combined with the soft-ground traveling ability of a crawler has been developed by the Universal Crane Company, Cleveland.

The attachment fits on any ordinary four-wheel truck, changing it into an eight-wheel unit with six of these wheels grouped at the rear of the truck where a crawler track can be quickly put around them, giving a full crawler

TRUCK CRANE FITTED WITH SPECIAL CRAWLER ATTACHMENT

rear end for soft-ground travel. In conjunction with the U. S. Wheel Track Layer Corporation, the Universal Crane Company has experimented and tested this unit for over a year. This attachment is used for crane mountings only on Universal cranes. The entire operation of attaching the treads takes approximately five minutes and can be handled by one man with no extra tools, save a hammer. The speed of travel of the unit as a crawler is 6 to 8 miles per hour over soft ground, although it has been driven over hard roads as high as 14 miles per hour. The driving of the unit is done by the standard truck mechanism, which is not changed in any respect. The operation is (1) to remove the track from the front of the rack and drive the truck forward until it is part way on the track; (2) remove the rest of the crawler track from the carrying rack and drive the truck forward until the track feeds completely around the rear wheels; (3) block the front truck wheels with small wooden blocks and let the engine clutch in quickly to give the rear driving wheels a quick "kick"; (4) this pulls the end links of the crawler track together so that no trouble is encountered in slipping a connecting tread pin into place, making the track a continuous belt over the rear wheels. As soon as the tension spring is tightened to produce sufficient tension on the tread belt, the unit is ready to go in on the job.

Equipped in this manner the unit has numerous advantages. It eliminates all fear of soft ground and necessity for planking. It means going straight in on the job, up over banks and depressions, over logs, through underbrush, etc.

New Trade Literature

ELECTROPLATING OUTFITS.—Bulletin E-95 issued by the W. Green Electric Company, 81 Nassau Street, New York City, describes Green's complete "Sal-Hyde" electroplating outfits for all trades and purposes.

DIESEL ENGINES.—The De La Vergne Machine Company, 977 East 138th Street, New York City, has issued a bulletin, entitled "De La Vergne Vertical Diesel Engine Details," which is a technical supplement to its recent vertical engine catalog. This bulletin calls attention to the design, ruggedness of construction, simplicity of operation and general reliability of the De La Vergne vertical Diesel engines. Numerous illustrations are given showing the various types of these machines. Charts showing a governor and fuel-pump arrangement and a lubricating oil system are included.

TRAFFIC CONTROL.—Bulletin LD 147A issued by the Edison Lamp Works of General Electric Company, Harrison, N. J., entitled "Lighting for Traffic Control," contains a synopsis of traffic control, embracing its necessity, effectiveness and cost. It describes and illustrates the various types of equipment for traffic control, both automatically and manually operated. It also calls attention to special features of "Mazda" lamps for traffic signal service.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Prague, Czechoslovakia (No. 25,418), of radio sets and parts.

An agency is desired in Sydney, Australia (No. 25,479), for wiring supplies and electric lighting fixtures.

A sole agency is desired in San Juan, P. R. (No. 25,581), for electric bread-slicing machines.

An agency is desired in Munich, Germany (No. 25,512), for electric irons, point-cutting machines, butchers' equipment, coffee grinders, cloth-cutting machines, massage apparatus, hair-cutting machines and household appliances.

Purchase or agency is desired in Milan, Italy (No. 25,578), for electric motors and controls.

An agency is desired in Helsingfors, Finland (No. 25,510), for radio sets and parts.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GLOUCESTER, MASS. — Plans have been filed by the Gloucester Electric Company for an addition to its power plant, to be equipped for switchboard service.

HARTFORD, CONN. — The Aviation Commission is seeking an appropriation of $7,000 for the installation of flood lights and maintenance of lighting equipment at the Brainard Aviation Field, Hartford.

Middle Atlantic States

BINGHAMTON, N. Y. — Bids, it is understood, will soon be asked by the State Hospital Commission, Capitol, Albany, for a cold storage and refrigerating plant at the Brighton State Hospital, Binghamton, to cost about $175,000. Sullivan W. Jones, Capitol, Albany, is state architect.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until May 24, for one gasoline engine-driven generator for the local navy yard. Also, for a similar unit for the Puget Sound navy yard. (Schedule 7191.)

BROOKLYN, N. Y.—The installation of a 135,000-hp. generating unit, making the fifth, has been authorized for the Hudson Avenue station, at the East River, of the Brooklyn Edison Company.

CATSKILL, N. Y. — The Board of Trustees is negotiating with the Central Hudson Gas & Electric Company, Poughkeepsie, for the installation of an ornamental lighting system on Main and West Bridge Streets.

GENEVA, N. Y. — The Empire Gas & Electric Company has applied for permission to extend its transmission lines in the towns of Tyre and Montezuma, and for authority to exercise franchises granted by the Town Boards.

HASTINGS, N. Y.—Permission has been granted the Seneca River Power Company, Baldwinsville, to extend its transmission line to Hastings and furnish electric service here.

JAMESTOWN, N. Y.—Plans are under consideration for the extension of the ornamental lighting system in the downtown business section.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for a substation at 256 West 124th Street.

NIAGARA FALLS, N. Y. — Plans are being prepared by the Certain-Teed Products Company, 100 East Forty-second Street, New York City, for a power house at its local plant.

POUGHKEEPSIE, N. Y. — Permission has been granted the Central Hudson Gas & Electric Company to extend its electric system in Marbletown, and its electric and gas service in Newburgh. The company has also been authorized to extend its electric and gas service in Ulster.

ROCHESTER, N. Y.—Plans are being considered by the Monroe County Park Commissioners for lighting Ellison Park. The installation of a new lighting system on Arnett Boulevard is also under consideration. The Rochester Gas & Electric Corporation furnishes the street lighting service in Rochester.

SCHENECTADY, N. Y.—The City Council contemplates the construction of a central fire-alarm station, to cost about $40,000 . R. L. Bowen, 143 State Street, is architect.

ATLANTIC CITY, N. J. — Permission has been secured by the Atlantic City Electric Company to erect a transmission line along the Somers Point-Mays Landing Road.

JERSEY CITY, N. J.—Plans are being prepared by the Public Service Electric & Gas Company, Newark, for the construction of a new electrical and mechanical service building at New York Avenue and Ferry Street.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia Rapid Transit Company for the constructon of an addition to its substation at Arrott Street and Frankfort Avenue, to cost about $32,000.

LUZERNE, PA. — The installation of ornamental lamps on Main Streets is under consideration.

NESQUEHONING, PA.—The City Council has authorized the installation of an improved fire alarm system.

PHILADELPHIA, PA. — Plans have been filed by the Department of Public Safety for the construction of a central fire-alarm substation at Forty-third Street and Kingsessing Avenue, to cost about $40,000.

PHILADELPHIA, PA.—Bids will be received by the Pennsylvania Railroad Company, until May 27, for electrical and mechanical apparatus and equipment, etc. (Contract 56-1927). C. E. Walsh, Room 415, 15 North Thirty-second Street, is purchasing agent.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Works, Bureau of Engineering, Room 216, City Hall, until June 8, for electrical and mechanical equipment for the Northeast sewerage pumping works at Wheatsheaf Lane and Richmond Street.

PHILADELPHIA, PA.—Bids will be received by the Board of Trustees, Home for the Training in Speech of Deaf Children, 2201 Belmont Avenue, until May 26, for electrical work in connection with extensions and improvements at the institution.

PHILADELPHIA, PA.—Bids will be received by the Department of City Transit, 1214 Chestnut Street, until May 31, for switching and control equipment and auxiliary transformers for substations Nos. 4, 5 and 6, for the Broad Street subway system.

PLAINS, PA. — Permission has been granted to the Hudson Coal Company to erect a high-tension line through the township near the Wilkes-Barre city boundary line.

LOCH RAVEN, MD.—Plans are being prepared for a power plant at the Maryland Training School for Boys in connection with a new mechanical laundry, to cost about $125,000. Henry P. Hopkins and Allen Burton, 347 North Charles Street, Baltimore, are architects.

HUNTINGTON, W. VA.—Plans for the proposed mill on Camden Road to be built by the Huntington Sash, Door & Trim Company, to cost about $110,000, include a power plant.

HARRISONBURG, VA. — Investigations are being made by the Chamber of Commerce with a view of installing an ornamental lighting system on Main, East and West Market Streets and Court Square.

PETERSBURG, VA.—Steps have been taken by the Chamber of Commerce to secure the installation of an ornamental lighting system on portions of Sycamore, Halifax and Washington Streets.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until May 31, for a quantity of dry and flashlight batteries for eastern and western yards (Schedule 7215). Also, until May 24, for motor generators for the Anacostia yard (Schedule 7238).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until June 3, for 200 street-lighting globes, 200 dome reflectors, 320 porcelain reflectors, 10,000 ft. of wire, etc. (Panama Circular 1805.)

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, Washington, until June 10, for fourteen 60-in. mobile searchlight units, (Circular 10), postponed from May 17.

North Central States

DETROIT, MICH.—Plans for the proposed new units to be erected at the local works of the Briggs Manufacturing Company, to cost about $1,500,000, include a power plant.

MARQUETTE, MICH.—The installation of an ornamental lighting system on portions of Front and Ridge Streets is under consideration by the City Council.

COLUMBUS, OHIO.—A petition for the installation of an ornamental lighting system on West Goodale Street has been submitted to the City Council.

COLUMBUS, OHIO.—Plans are being prepared by the Columbus Railway, Power & Light Company for an addition to its substation at 181 West Mound Street, to cost about $40,000.

CALHOUN, KY.—The local plant of the General Power & Light Company, 231 South La Salle Street, Chicago, was recently destroyed by fire, causing a loss of about $21,000.

FALMOUTH, KY.—The City Council is considering the installation of a municipal electric lighting plant.

SCOTTSVILLE, KY. — Steps have been taken by the City Council and the Scottsville Commercial Club to establish a municipal electric light plant.

ELKHART, IND.—Plans are being prepared for improvements in the power house at the factory of Henry Weis Company, to cost about $25,000. Hubert Miller, is architect.

ELKHART, IND.—The installation of additional lamps in the business and outlying residential districts has been approved by the City Council. The lamps will be installed by the Indiana & Michigan Electric Company, South Bend.

EVANSVILLE, IND. — The North Side Electric Company, recently incorporated, plans to supply electricity to residents in the northeast section of Evansville. August Peters is one of the incorporators.

HUNTINGTON, IND.—The City Council has authorized the Board of Public Works to secure plans and to advertise for bids on two 500-kw. generators for the municipal electric plant. Bonds to the amount of $60,000 have been authorized for the proposed improvement.

RENSSELAER, IND. — Extensions are contemplated to the municipal electric plant for which funds to the amount of $43,000 have been authorized.

CHICAGO, ILL.—Bids will be received by the Signal Corps, Procurement District, Chicago, until May 25, for a quantity of switchboard supplies.

JACKSONVILLE, ILL. — Plans are under way by the City Council for the construction of a municipal electric light and power plant, to cost about $100,000. H. S. Caldwell, Ayeres Bank Building, is architect and engineer.

BAKERVILLE, WIS. — The Bakerville Electric Line Extension Association, will soon begin the construction of a transmission line from Marshfield for local light and power service.

OSHKOSH, WIS.—Plans are under way by the Universal Motor Company for the construction of a new plant including a power house on Harrison Street.

HIBBING, MINN.—The Commonwealth Electric Company, St. Paul, has been awarded contract for extensions to the municipal electric light plant, to cost about $80,000. Ralph D. Thomas, 1200 Second Avenue South, Minneapolis, is engineer.

PAYNESVILLE, MINN. — The erection of a high-tension line from Paynesville to Atwater is under consideration by the Northern States Power Company, Minneapolis.

FORT DODGE, IOWA.—Plans are being considered by the Crystal Ice & Storage Company, for the construction of an ice-manufacturing plant at Sixteenth Street and Crystal Avenue.

SHELDON, IOWA.—At an election held recently the proposal to issue $50,000 in bonds to build a municipal electric plant was defeated.

STUART, IOWA.—The City Council has voted to rebuild the municipal electric light plant. It is proposed to change the system from direct to alternating current.

TIPTON, IOWA—The City Council is planning for the installation of an ornamental lighting system on Cedar Street.

ST. LOUIS, MO.—Plans have been filed by the Laclede Power & Light Company for the construction of an addition to its substation at Sarah and Evans Avenues, to cost about $35,000.

ST. LOUIS, MO.—Plans have been filed by the Polar Wave Ice & Fuel Company for the construction of a cold storage and refrigerating plant, to cost about $50,000. H. G. Clymer, Wainwright Building, is architect.

DEVILS LAKE, N. D.—Plans are being considered by the Otter Tail Power Company, Fergus Falls, Minn., for improvements to its local plant and the erection of a high-tension line from Devils Lake to Oberon via Fort Totten.

MARION, S. D.—The Northern States Power Company, Sioux Falls, which has acquired the local electric plant, is planning extensions in transmission system at Marion and vicinity.

BLAIR, NEB.—Extensions and improvements are contemplated to the municipal electric light plant, to cost about $50,000. The plans include the installation of a 300-kw. generating unit, later on a 500-kw. unit. The Pillsbury Engineering Company, 2344 Nicollett Avenue, Minneapolis, is engineer.

ORLEANS, NEB.—To meet the increasing demands for electric service in this section the Western Public Service Company, Colorado Springs, Colo., is increasing the voltage of its transmission line from its plant in Alma to Orleans from 6,500 to 13,200 volts. The company is also converting its transmission lines between Bridgeport, Broadwater and Dalton from single to three phase.

WAKEFIELD, NEB. — Improvements and extensions are contemplated to the municipal electric light plant, including the construction of a new power station and installation of transformers, etc. The system will be changed from direct to alternating current.

Southern States

STATESVILLE, N. C.—The A. B. Shoe Company, recently organized, plans to install electric power equipment in its proposed local factory, to cost about $300,000.

KINGSLAND, GA. — The City Council has granted a franchise to Howard P. Morris, 2036 Riverside Avenue, Jacksonville, Fla., for the construction of a power plant.

JACKSONVILLE, FLA.—Plans for the proposed local engine terminal and repair shops for the St. Johns River Terminal, include a power plant.

OCALA, FLA.—The Florida Power Corporation, St. Petersburg, is planning extensions in transmission line in this vicinity.

POLK CITY, FLA. — Bonds to the amount of $45,000 have been authorized for the purchase of the local electric light plant, to be owned and operated by the municipality. Extensions and improvements are contemplated to the system.

CULLEOKA, TENN. — The Southern Cities Power Company, Chattanooga, plans extensions in transmission lines at Culleoka, Moorsesville and vicinity.

COLUMBUS, MISS. — Bids will be received at the office of the president of the Mississippi State College for Women by the Mississippi Building Commission as follows: Lighting fixtures for the dining hall, dormitory, physical education building and administration building; refrigeration plant and insulation; new boiler, smoke stack, vacuum pump, feed pump and heater, etc. P. J. Krouse, Meridian, is architect.

UTICA, MISS.—The City Council is considering the construction of a municipal ice-manufacturing plant on Main Street.

CROWLEY, LA.—The Gulf States Utilities Company, Lake Charles, which has acquired the municipal electric plant, contemplates the erection of a transmission line in this section.

HATTIESBURG, MISS.—Improvements are contemplated by the Mississippi Power Company, Gulfport, to its local plant, including rebuilding the switchboard and installing larger switches.

FREDERICK, OKLA.—Extensions to the municipal electric plant are under consideration by the City Council.

HINTON, OKLA. — The Southwestern Light & Power Company, Oklahoma City, which has acquired the municipal electric plants, contemplates extensions in transmission lines in this vicinity and at Burbank.

AMARILLO, TEX.—A franchise has been granted to the Panhandle Light & Power Company to furnish electric service in Magic City. The company plans to build a power station, to cost about $88,000.

ANGLETON, TEX.—The Texas-Louisiana Power Company, Fort Worth, which has acquired the electric plant of the Angleton Light & Ice Company, plans to erect transmission lines to Velasco, East Columbia, Sweeney, Danbury and other towns in this section.

AUSTIN, TEX.—Plans have been filed by the Board of Trustees, University of Texas, for the construction of a power plant, to cost $250,000. The Herbert M. Greene Company, Santa Fe Building, Dallas, is architect.

BIG LAKE, TEX.—Plans for the proposed municipal waterworks include the installation of electrically-operated pumping machinery. The project will cost about $80,000. The Devlin Engineering Company, Amarillo, is engineer.

FORT WORTH, TEX.—Plans are under consideration by the Texas-Louisiana Power Company to erect a power plant at Brazoria and also a plant at Velasco, near the Brazoria River.

HOUSTON, TEX.—The Houston Lighting & Power Company, which has acquired the property of the South Houston Lighting & Power Company, plans extensions and improvements to the system in South Houston.

JASPER, TEX.—The Gulf States Utilities Company, Beaumont, has acquired the Jasper Electric Company and is planning extensions in transmission lines.

McALLEN, TEX. — The Rio Grande Valley Cold Storage Company plans to build an ice-manufacturing and cold storage plant, to cost about $150,000.

Pacific and Mountain States

WENATCHEE, WASH.—The Milmeroth Service & Cold Storage Company contemplates the construction of a new one-story cold-storage and refrigerating plant, to cost about $40,000.

PORTLAND, ORE.—The National Biscuit Company plans the installation of electric power equipment in its proposed local plant, to cost about $500,000.

LOS ANGELES, CAL.—The Board of County Supervisors has approved plans for the installation of ornamental lamps on Seville Avenue, between Santa Ana and Olive Streets, using metal standards.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on portions of Cedarhurst Drive, using concrete standards; on Bella Vista Way, using cast iron standards; and on Mountain View and Westlake Avenues, using pressed steel standards, also on Cadillac Avenue.

MODESTO, CAL.—The City Council is considering a petition for the installation of an ornamental lighting system on portions of Tenth Street. Frank Rossi is city engineer.

PASADENA, CAL.—A petition has been filed with the City Directors for the installation of ornamental lamps on Armada Drive and Prospect Boulevard.

POMONA, CAL.—The City Council is considering the installation of an ornamental lighting system on Holt Avenue, using metal standards. F. C. Froehde is city engineer.

SAN CARLOS, CAL.—The City Council plans to install an ornamental lighting system in the San Carlos Garden district.

SAN DIEGO, CAL.—The City Council has authorized the installation of an ornamental lighting system on Voltaire Street, using concrete standards. Also on portions of Fourth Street and Walnut Avenue, using metal standards.

SAN FRANCISCO, CAL. — The Great Western Power Company, has authorized the erection of a transmission line from Bucks Creek to Brighton Station, using steel towers, to cost about $375,000.

STOCKTON, CAL.—The City Council plans to install an ornamental lighting system on Eldorado Avenue, using malleable-iron standards.

STOCKTON, CAL.—The City Council has authorized the installation of an ornamental lighting system on portions of Lindsay, Center, El Dorada and Freemont Streets, using duplex lamp standards, with underground conduit. W. B. Hogan is city engineer.

WOODLAND, CAL.—The State Highway Department, Sacramento, is contemplating the installation of an ornamental lighting system on the Yolo Causeway, to cost about $15,000.

NOGALES, ARIZ.—Plans have been prepared by the Southern Arizona Power Company for an addition to its local electric power plant, to cost about $75,000.

ROCK CREEK, MONT.—Application has been made by M. I. Richel, Red Lodge, to the Federal Power Commission for a license to construct a 1,000 ft. diversion flume and a power house on Black Fork, in Carbon County.

TULSA, WYO. — Permission has been granted A. I. Rose, Louis Fourth and C. C. Ahervil, by the Public Service Commission to install a municipal electric plant in Tulsa, a new town recently established.

COLLBRAN, COL. — A committee has been appointed to investigate the establishment of an electric system in Collbran. Proposals to build a hydro-electric plant or to secure electricity from Shoshone or Grand Junction are under consideration.

DENVER, COLO.—Bids will be received by the Bureau of Reclamation, Denver, until June 10, for five gates and five gate hoists for the Klamath project, Oregon-California.

FLORENCE, COL.—Plans are under consideration by the Southern Colorado Power Company, Pueblo, for extending its transmission lines from Florence into the oil fields south of the city.

NYDEN, PARK, COLO. — Preliminary plans are under way by Wood & Weber, Tramway Building, Denver, Colo., for the construction of a new power house in Nyden Park, a new town recently established.

Canada

EDMONTON, ALTA.—Plans are under way by the Canadian National Railways, Winnipeg, Man., for the construction of a new local power house, to cost about $50,000.

SHERBROOKE, QUE.—The ratepayers have approved a by-law providing for an expenditure of $50,000 for developing additional power at Westbury.

LANIGAN, SASK.—Bids will be received by George L. Craddock, town clerk, until June 1 for furnishing and erecting internal combustion engines, generators, exciters, switchboard, street-lighting apparatus, meters, pole line material, etc., and construction of power station and cooling chamber. A. A. Murphy, Saskatoon, is consulting engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 26, 1927)

1,626,165. ELECTRIC SWITCH; H. A. Spahr, Milwaukee, Wis. App. filed April 19, 1926. Limit switch.

1,626,173. DRY CELL; V. Yngve, South Orange, N. J. App. filed Jan. 25, 1924. Construction and arrangement of zinc electrode.

1,626,180. LIGHTNING-ROD CONNECTOR; B. C. Burkett, Fremont, Ohio. App. filed June 4, 1924.

1,626,182. ELECTRICAL APPARATUS; J. G. Campbell, Dayton, Ohio. App. filed Feb. 24, 1923. Means for connecting the rotor of the motor with a driven shaft after a certain rotor speed has been obtained.

1,626,199. DYNAMO-ELECTRIC MACHINE; F. Kesselring, Furth, Germany. App. filed April 14, 1926. For motor vehicles suitable for supplying continuous current for lighting lamps and also high-voltage current for igniting the explosive charge.

1,626,213. METHOD OF TREATING LIQUID-INSULATED TRANSFORMERS; E. Stenkvist, Ludvika, Sweden. App. filed June 26, 1926. Consisting in drying the transformer, filling the receptacle containing it with a dry gas under a pressure slightly higher than that of the atmosphere for storing or transport, expelling the gas and introducing liquid after storing or transport.

1,626,221. ELECTRIC HEATING SYSTEM; G. R. Blakesley, Janesville, Wis. App. filed Dec. 7, 1922. Three-heat three-wire electric switch.

1,626,233. MULTIPLE-CIRCUIT SWITCH; B. E. Getchell, Plainville, Conn. App. filed April 25, 1925. In which two circuits are automatically opened in case of an overload in either one.

1,626,235. METHOD OF APPLYING A GETTER TO VACUUM DEVICES; D. S. Gustin, Newark, N. J. App. filed Sept. 12, 1922.

1,626,263. FURNACE AND METHOD OF OPERATING THE SAME; F. W. Brooke, Pittsburgh, Pa. App. filed Oct. 11, 1922. Which consists in simultaneously subjecting two furnaces to the action of electrical units, one to melt down the charge therein and the other to refine a similar charge previously melted down by the first unit.

1,626,290. ELEVATOR LEVELING CONTROL; A. J. Liebenberg, Cincinnati, Ohio. App. filed Dec. 13, 1924.

1,626,295. ELECTRIC HEATER FOR STEAM BOILERS AND SUPERHEATERS; W. A. Patscheider, Auburndale, Mass. App. filed March 27, 1924.

1,626,315. ELECTRIC LAMP; G. Venturini, Santiago, Chile. App. filed Jan. 14, 1925. Means for adjusting to different candlepowers.

1,626,367. MAGNETO GENERATOR; O. Thompson, New York, N. Y. App. filed Feb. 15, 1919. Of a type equipped with primary and secondary windings.

1,626,376. REWINDING REEL; E. G. Anderson, Chicago, Ill. App. filed Aug. 14, 1919. For use in connection with extension fixtures, such as lamps and the like.

1,626,431. ELECTRIC FURNACE; J. A Seede, Schenectady, N. Y. App. filed Dec. 24, 1925. Control for arc furnace used in the melting and refining of metals.

1,626,437. INDUCTION FURNACE; M. Unger, Pittsfield, Mass. App. filed Dec. 31, 1925. Having a pronounced circulation of the charge.

1,626,451. SYSTEM OF ELECTRIC DISTRIBUTION; F. J. Champlin, Dalton, Mass. App. filed July 6, 1925. For systems comprising a plurality or parallel feeders between a common source and a common distribution circuit. An arrangement for automatically controlling voltage-modifying means in parallel feeders whereby only one current transformer is used in each feeder and whereby the number of feeders in service may be varied without changing the adjustment of any of the apparatus.

1,626,461. PUSH-BUTTON SWITCH; R. W. Goff, Schenectady, N. Y. App. filed Dec. 9, 1924. Means whereby the switch may be locked in a desired position.

1,626,462. ELECTRIC CUT-OUT; C. I. Hall, Fort Wayne, Ind. App. filed Aug. 8, 1924. Thermal plug type.

1,626,467. AUTOMATIC-RECLOSING CIRCUIT-BREAKER SYSTEM; B. W. Jones, Schenectady, N. Y. App. filed Dec. 20, 1921.

1,626,469. ELECTRIC SWITCH; G. S. Leddick, Schenectady, N. Y. App. filed Jan. 2, 1923. Having a plurality of switch members and a common actuating means for them, together with an interlocking arrangement between the switch members whereby operating the actuating means in one direction first imparts one relative movement to the switch members and then imparts a different relative movement to the switch members.

1,626,472. FEED FOR ARC LAMPS; P. Mole, Jr., Schenectady, N. Y. App. filed April 30, 1923.

1,626,485. INDUCTION FURNACE; M. Unger, Pittsfield, Mass. App. filed Feb. 16, 1921. Particularly adapted for the melting of non-ferrous metals of high conductivity.

1,626,488. STORAGE-BATTERY SYSTEM; O. C. Wiederhold, Philadelphia, Pa. App. filed Sept. 14, 1926. For self-propelled vehicles to prevent constant overcharging.

1,626,495. AUTOMATIC-RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Schenectady, N. Y. App. filed June 5, 1922.

1,626,513. OIL-IMMERSED ELECTRIC SWITCH; F. Coates, Cleadon, England, and J. Mirrey, East Bolden, England. App. filed June 27, 1925. Switch fuse.

1,626,515. TEMPERATURE CONTROL FOR FOLDING MACHINES, ETC.; O. E. Cook, Troy, N. Y. App. filed Nov. 14, 1925.

1,626,524. DEVICE FOR THE ELECTRICAL WELDING OF SEAMED TUBES; P. Gedien, Cologne-Braunsfeld, Germany, and K. Schwade, Cologne-Lindenthal, Germany. App. filed Oct. 28, 1926.

1,626,528. ELECTRIC CIRCUIT BREAKER; R. W. Gregory, Hexham-on-Tyne, England. App. filed July 22, 1925. Oil-immersed circuit breaker for use on high-voltage systems where a quick break with a long gap is desirable.

1,626,560. TRANSMITTING APPARATUS UTILIZING THE PRINCIPLE OF THE WHEATSTONE BRIDGE; E. Schneider, Paris, France. App. filed Jan. 4, 1922.

1,626,570. ELECTRICAL WIRING SYSTEM; H. S. Walker, Ardmore, Pa. App. filed May 15, 1926. Of the concealed type which may be installed in a relatively shallow space. For office-building wiring.

1,626,580. ATTACHING PLUG; T. D. Finizio, Yorktown Heights, N. Y. App. field Aug. 11, 1921.

(Issued May 3, 1927)

16,614 (reissue). STORAGE BATTERY; T. A. Edison, West Orange, N. J. App. filed March 12, 1924. Of the alkaline type, in which a battery pile of special construction is employed in the place of the usual plate assembly in Edison storage-battery cells.

1,626,603. REGULATOR SYSTEM; W. W. Edson, Newtonville, Mass. App. filed June 23, 1925. Wherein a number of generators are connected together to operate in parallel-circuit relation. Means adapted to compensate for voltage line drop, for load current in the line, for leading or lagging wattless current in the line, and also for cross-currents between the generators.

1,626,616. SADIRON; W. H. Lanak, Minneapolis, Minn. App. filed Jan. 20, 1926. Fitted with a thermometer.

1,626,622. INDUCTION MOTOR; H. Moeller, Cologne-Bayenthal, Germany. App. filed June 1, 1925. Having automatic means for controlling the impedance in the secondary winding. An induction motor which will develop a high starting torque with minimum current and will have good speed regulation under normal operating conditions, while avoiding circuit-interrupting switches and the like, for controlling the resistance in the secondary of the motor.

1,626,628. SEALING-IN HEAD FOR INCANDESCENT ELECTRIC LAMPS; W. S. Rotherham, Little Falls, N. J. App. filed May 22, 1926.

1,626,637, 1,626,638, 1,626,639. GETTER FOR CONTROLLING CRYSTAL GROWTH; W. C. Sproesser, Bloomfield, N. J. Apps. filed Dec. 6, 1922, and May 5 and Aug. 21, 1923. For application to a thoriated tungsten filament for an incandescent electric lamp comprising thoria for increasing the life and bump-test strength.

1,626,640. EVACUATION OF BULBS AND THE LIKE; W. C. Sproesser, Bloomfield, N. J. App. filed Sept. 7, 1923.

1,626,650. SWITCH MECHANISM; E. H. Ullrich, New York, N. Y. App. filed Aug. 3, 1921. Safety inclosed interlocked type.

1,626,656. ELECTRIC FURNACE HEATING UNIT; J. C. Woodson, East Pittsburgh, Pa. App. filed Dec. 7, 1923. For electric resistance furnaces.

1,626,658. MANUFACTURE OF INCANDESCENT LAMPS; H. G. Anderson, East Orange, N. J. App. filed April 29, 1922. A device for applying and indicating the tension on a lamp filament being formed.

1,626,659. CONTROL APPARATUS; B. O. Austin, Wilkinsburg, and W. G. Horn, Bryn Mawr, Pa. App. filed May 24, 1921. For governing the operation of relatively complicated control systems, such as those employed in electric cars.

1,626,660. SWITCHBOARD; W. G. Balph, East Orange, N. J. App. filed Feb. 26, 1921. Dead-front.

1,626,665. RELAY; R. Brooks, Ashton-on-Mersey, England. App. filed April 9, 1920. Time-limit-overload relay.

1,626,677. STEM FOR INCANDESCENT LAMPS AND METHOD OF MAKING; J. J. Higgins, East Orange, N. J. App. filed March 25, 1922.

1,626,678. COMBINATION INSERTING AND WELDING MACHINE; J. J. Higgins, East Orange, N. J. App. filed Dec. 31, 1923. For inserting support wires into lamp stems.

1,626,679. LAMP-MAKING MACHINE; H. D. Kelly, Bloomfield, N. J. App. filed Oct. 12, 1923. For performing the exhausting operation.

1,626,681. MAGNET; P. MacGahan, Pittsburgh, Pa. App. filed Jan. 8, 1924. Electrical measuring instrument magnet that is responsive to temperature changes.

1,626,682. GETTER AND METHOD OF APPLYING THE SAME; D. MacRae, East Orange, N. J. App. filed May 18, 1921.

1,626,684. CONDENSER; R. E. Marbury, Wilkinsburg, Pa. App. filed Oct. 1, 1923. Using asbestos as a dielectric in condensers especially adapted for high-frequency application.

1,626,688. AUTOMATIC STATION; W. L. Newmeyer, Wilkinsburg, Pa. App. filed Feb. 18, 1924. Comprising a plurality of translating apparatus.

1,626,692. SWITCH CONTACT; A. Rawling, Wilkinsburg, Pa. App. filed Nov. 5, 1923. Contact mechanism used in circuit breakers of the truck-panel type.

1,626,695. AUTOMATIC FLASHING MACHINE; H. M. Robins, Glen Ridge, N. J., and J. J. Higgins, East Orange, N. J. App. filed Oct. 22, 1923. For flashing lamp filaments.

1,626,732. METHOD OF VAPORIZING A GETTER IN AN EVACUATED VESSEL; W. H. Holden, New York, N. Y. App. filed March 23, 1922.

1,626,769. ELECTRIC WELDING APPARATUS; E. J. von Henke, Chicago, Ill. App. filed May 13, 1922. For spot welding.

1,626,774. METHOD OF WELDING AND PRODUCT THEREOF; W. G. Allan, Toronto, Ontario, Canada. App. filed Feb. 3, 1920. Method of providing sheet-like foraminous metal material with stiffening means which comprises fusing a marginal portion of the material.

1,626,776. ELECTRICAL CONDUCTOR WITH REINFORCING CORES; A. O. Austin, Barberton, Ohio. App. filed June 25, 1924.

1,626,777. HIGH-POTENTIAL CONDUCTOR; A. O. Austin, Barberton, Ohio. App. filed June 26, 1924.

1,626,795. VISUAL ANNUNCIATOR; W. T. Dippel, New York, N. Y. App. filed March 18, 1922.

1,626,875. ELECTRIC CONNECTER FOR BRANCH CIRCUITS; A. W. Reiser, Toledo, Ohio. App. filed April 10, 1925. For connecting a plurality of wires together.

1,626,899, 1,626,900. ELECTRIC SIGN; F. E. Wilde, Meadowmere Park, N. Y. Apps. filed Sept. 23, 1925, and March 24, 1926. "Talking" sign and control therefor.

1,626,909. BONDING PIN; L. H. Ayer, Chicago, Ill. App. filed Feb. 9, 1923. For connecting electrical conductors to rails.

1,626,932. FEEDING MEANS FOR ARC LAMPS; T. Hall, Brooklyn, N. Y. App. filed Oct. 13, 1923.

1,626,970. VOLTAGE REGULATOR FOR TRANSFORMERS; A. Rooth, Ludvika, Sweden. App. filed March 17, 1926. In which the shifting of the outgoing leads from one tap to another shall be possible during service.

1,627,001. SYSTEM OF UNIFYING A GROUP OF CLOCKS; M. Yokoyama, Setagaya-Cho, Japan. App. filed May 25, 1926.

1,627,029. AUTOMATIC CIRCUIT BREAKER; M. E. Greenway and R. W. Chambers, Whitewright, Tex. App. filed May 8, 1925. To replace fuses usually employed in house wiring and adapted for use in a standard receptacle.

1,627,070. METALLIC VAPOR DEVICE; E. Weintraub, Neuilly-sur-Seine, France. App. filed Dec. 14, 1923. Means for fixing the cathode spot.

1,627,158. ELECTRICAL SWITCH; J. Dominiczak, Braddock, Pa. App. filed April 29, 1926. Of the type called pole changers, being in the form of a double-pole, double-throw switch and wherein by the provision of a continuous contact with the source of current supply one lead and terminal can be eliminated.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Expanding Importance of Electrical Industries

THE accompanying charts afford a comparison between the growth of the electrical manufacturing industry and the manufacturing industries as a whole in the United States from the year 1914 to 1925. They are based on preliminary reports of the results of the Census of Manufactures for 1925, recently completed by the Census Bureau, combined with data from previous reports. One item, the installed horsepower in 1921, had to be estimated on the basis of the best available information, because it was not included in the statistics collected by the bureau for that year.

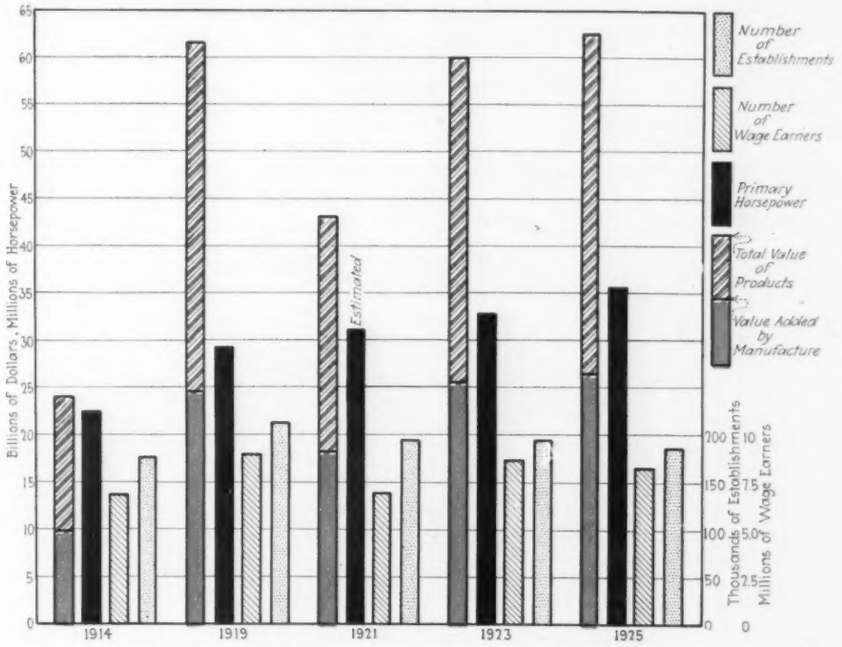
The increasing relative importance of the electrical manufacturing industry is particularly noticeable. In 1914 electrical products constituted 1.40 per cent in value of all manufactured products. In 1925 they constituted 2.45 per cent. This is an increase of 75 per cent in relative importance. If, instead of total value, the value added by manufacture is taken as the criterion of growth, it is found that the percentage changed from 1.85 in 1914 to 3.37 in 1925, a relative gain of 82 per cent.

The installed horsepower in the electrical industry grew from 226,320 in 1914 to 589,398 in 1926, a gain of 160 per cent; in the same interval the total primary horsepower in all industries rose from 22,401,401 to 35,735,000, an increase of but 69 per cent, from which it appears that in this respect also the electrical manufacturing industry has been advancing much more rapidly than manufacturing industry in general.

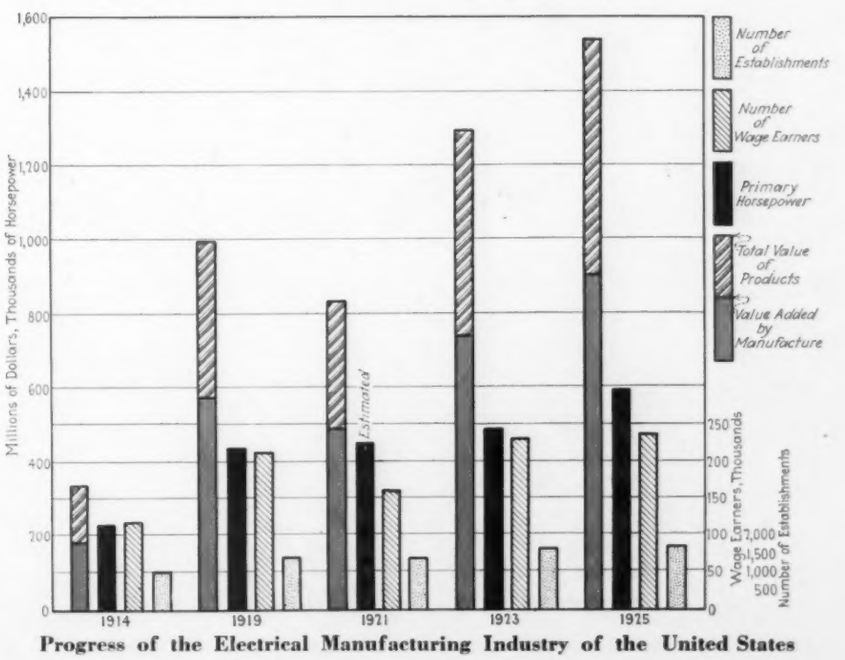
Although the physical rate of increase, both in installed horsepower and in number of wage earners, has been materially greater in the electrical industry than in manufacturing industry in general and the power per employee has been increasing steadily, it has been consistently smaller in the electrical field than in the general average. In the latter the iron and steel industry with its huge power requirements makes itself felt. In contrast, various important branches of electrical manufacturing involve light operations calling for the employment of many individuals without requiring much power.

Finally, the number of electrical manufacturing establishments increased by 70 per cent from 1914 to 1925, whereas the total number of all kinds of manufacturing establishments had a net increase of only 6 per cent during the same period after rising to a peak in 1919.

Apparently, whatever be the basis of comparison, neither the gain in 1919 nor the setback in 1921 struck the electrical industry as violently as they affected industry in general.



Progress of the Manufacturing Industry of the United States



Progress of the Electrical Manufacturing Industry of the United States

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Production in Middle Atlantic States Continues Under 1926

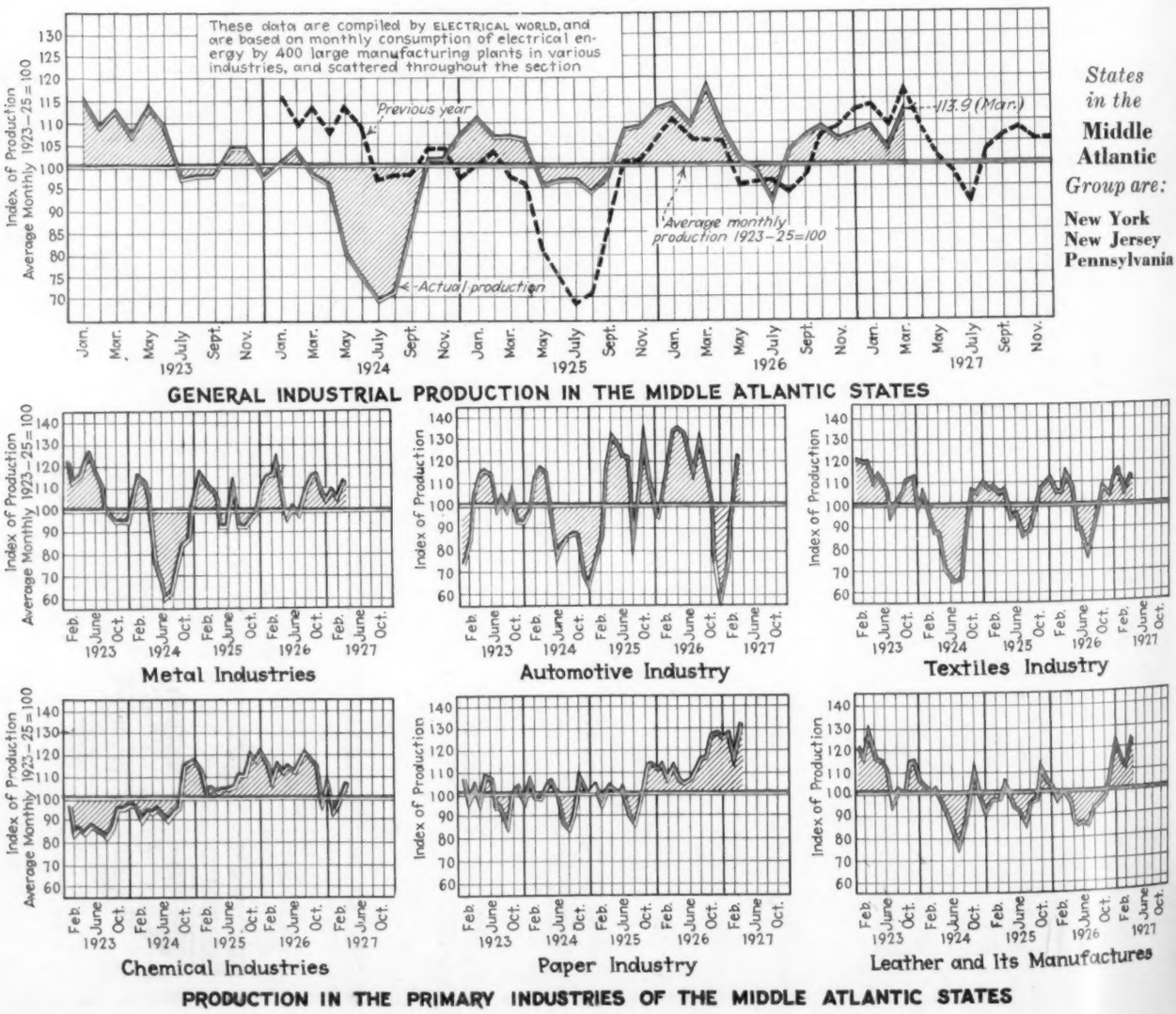
PRODUCTIVE operations of the manufacturing plants in the Middle Atlantic States were of a high order during the first quarter of the year. Ever since the fall of 1925, with the exception of June and July of last year, the production of these plants has been above the monthly average for the period 1923-1925. Since last October, however, the monthly production in this section has been under that reported for the same month of the year previous. While industry in the Middle Atlantic States, therefore, has operated materially above the estimated normal during the period, yet since last October the monthly productive activity has been on a lower plane than during the same months of the year previous. Incomplete reports indicate that April production was about 7.5 per cent under April last year. Such are the present status and past development of industrial operations in the manufacturing plants of the Middle Atlantic States as indicated by the monthly consumption of electrical energy by about 400 large manufacturing plants operating in the section.

On account of the high rate of production during the first quarter of the year the indications are that industrial production during the coming summer months will be slightly under that which would normally be expected at that season of the year. There is nothing on the horizon, however, to indicate that industrial production during the coming fall months will not increase over the summer months in a perfectly normal manner. Clearly, business and industry are operating today above the estimated normal, but there is nothing in view to indicate that they may not continue in this general way for some time to come. That 1927 production will overtop the records of 1926 is unlikely in view of the improbability of a further expansion in the building and automobile industries. On the other hand, that it will fall materially below 1926 is equally unlikely as long as credit supplies continue abundant.

Incomplete reports indicate that the automobile and chemical plants in the Middle Atlantic States increased their activities during April over March, but that the metal group, textiles, paper and the leather industriess all recorded decreased operations during the month. The iron and steel mills decreased production while the metal fabricating plants increased operations.

"Electrical World" Barometer of Industrial Activity in the Middle Atlantic States

(Data Unadjusted for Seasonal Variation)


These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Production Average Monthly 1923–25 = 100
Previous year
113.9 (Mar.)
Average monthly production 1923–25=100
Actual production
States in the Middle Atlantic Group are:
New York
New Jersey
Pennsylvania
GENERAL INDUSTRIAL PRODUCTION IN THE MIDDLE ATLANTIC STATES
Metal Industries
Automotive Industry
Textiles Industry
Chemical Industries
Paper Industry
Leather and Its Manufactures
PRODUCTION IN THE PRIMARY INDUSTRIES OF THE MIDDLE ATLANTIC STATES